Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

APRIL, 1958

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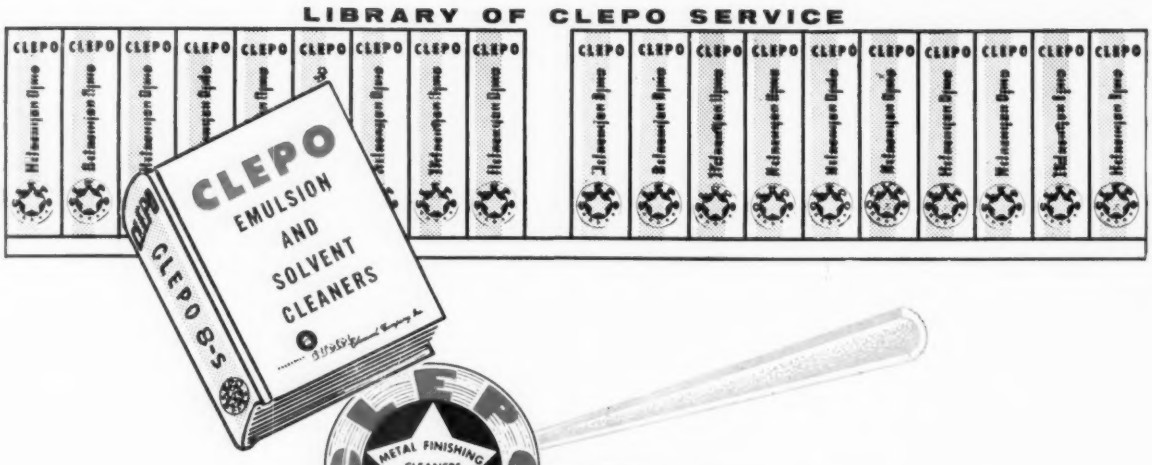
Read and pass on—



CLEPO 8-S

A VERSATILE EMULSION CLEANER

Consider these four different applications for which, among other uses, CLEPO 8-S long ago proved its effectiveness and economy in action.

- ★ removing drawing compounds from extruded aluminum parts.
- ★ cleaning in spray-type or tumble-type washing machines.
- ★ cleaning large pieces too heavy to handle or to immerse in a tank; it's applied directly to the surface with brush or swab and then hosed off.
- ★ cleaning paint brushes.

These are suggestions as to how CLEPO 8-S can help keep both work and equipment clean of grease, oils, polishing compounds, dirt and smut. There are other uses for CLEPO 8-S and there are other CLEPO Solvents and Solvent-Emulsion Cleaners to do other work.

Cleaners make up an important phase of CLEPO Service. If you are having cleaning trouble—either in effectiveness of work or costs—ask the CLEPO Field Man to go over the long list of CLEPO Cleaners and see if one of them won't take care of your problem better.

For more than twenty-five years the CLEPO Technical Staff has devoted its attention to cleaning, stripping, tumbling and other problems encountered daily in the metal finishing field. This service is at your disposal.

FREDERICK GUMM *Chemical Company Inc.*

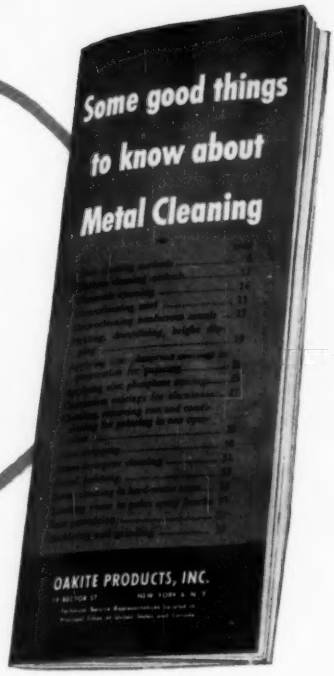
538 FOREST STREET, KEARNY, N. J.

How to make metal stripping an exact science: What metal do you want to strip? There are eight metal strippers in the Enthone "ENSTRIP" series, which, in most cases, will do the specialized job thoroughly, quickly, economically. If one of these standard strippers won't precisely cover your requirements, there are special Enthone research developments available. Write us about your particular needs or problems. Include a sample of your product if possible. We'll be glad to recommend the best methods to follow. Enthone, Inc., 442 Elm Street, New Haven 11, Conn.

ENTHONE

ENTHONE, INC. IS A SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

WHICH METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?



¶ Are you cleaning metal in the most economical way? *See page 9 of Oakite's FREE booklet on Metal Cleaning.*

¶ Are you cleaning metal the fastest way? *See page 12.*

¶ Do you need room-temperature cleaning combined in one operation with temporary rustproofing? *See pages 12 and 14.*

¶ Do you know the advantages of *alkaline* pickling? *See page 21.*

¶ Have you compared the values of iron phosphate coating and zinc phosphate coating in preparation for painting? *See pages 22 and 25.*

¶ Can you use a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 30.*

¶ Do you have trouble stripping epoxy resins, pigment residues, phosphate coatings and under-paint rust? *See page 31.*

¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? *See page 31.*

¶ Are you getting full profit out of your finishing barrels? *See page 32.*

¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? *See page 35.*

¶ Do you need better protection against rusting in process or in storage? *See page 37.*

Here is the full table of contents of Oakite's 44-page illustrated booklet called "*Some good things to know about Metal Cleaning*".

Tank cleaning methods
Machine cleaning methods
Ultrasonic cleaning
Electrocleaning steel
Electrocleaning nonferrous metals
Pickling, deoxidizing, bright dipping
Applying iron phosphate coatings in preparation for painting
Applying zinc phosphate coatings
Conversion coatings for aluminum and zinc
Cleaning, removing rust and conditioning for painting in one operation
Paint stripping
Steam-detergent cleaning
Barrel finishing
Better cleaning in hard-water areas
Treating water in paint spray booths
Rust prevention
Machining and grinding

SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U.S. and Canada
Export Division Cable Address: Oakite

FREE For your copy of "*Some good things to know about Metal Cleaning*" write to Oakite Products, Inc., 18 Rector St., New York 6, N. Y.

4/Circle on Readers' Service Card

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For 59 Years ...L'HOMMEDIEU...

year after year has manufactured Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

RELIANCE PLATING BARRELS

Easy to Handle . . . Save Time and Money
Uniform Current Distribution
Plating Begins at Once

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Lucite — Hard Rubber or Bakelite Cylinders
Motor — Geared in Head
Minimum Maintenance

* * *

Write for Reliance Plating Barrel Specifications

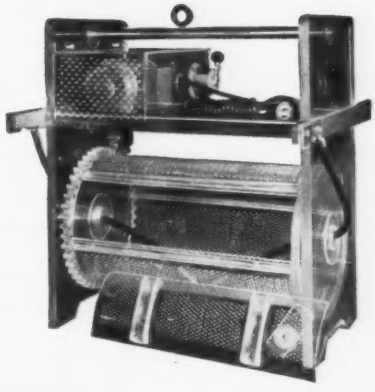
RELIANCE SELENIUM RECTIFIERS

Designed for all metal finishing operations.

High power factor and low ripple.

6 to 48 volts D.C.

Basic-self-contained or with Remote Control.



RELIANCE LUCITE

Portable Plating Barrel

Built of extra heavy High Temperature Lucite for volume production and stability.

Cylinder: 10"x18" inside. Equipped with Reversing Switch to permit stopping and securing barrel for loading and/or unloading.

Chas. F. L'Hommedieu & Sons Co.

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Cleveland & Los Angeles

NORTHWEST
LEADS THE WAY WITH CHEMICALS FOR USE WITH
ALUMINUM

If you work with aluminum you'll be interested in Northwest's outstanding line of chemicals for use with modern alloys. Northwest's continuing research and development program has earned them the reputation of "First with the best" in this rapidly developing field. It will pay you to investigate:

REMEMBER!

"Your cost per finished article is the true cost of your cleaner."

- **ALKALUME CLEANERS**—A full line of cleaners and etching compounds especially formulated for use on aluminum alloys prior to plating, anodizing, painting or welding.
- **ALKALUME PRE-PLATE**— An especially effective zincate bath for preparing aluminum for plating.
- **ANOSTRIP**—An easily handled liquid product, excellent for stripping anodic film from aluminum surfaces and racks without damage.
- **ALKALUME DS**— An efficient, economical, 100% active product for removal of etching smut at room temperature.

Northwest products are manufactured on the West Coast by
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NORTHWEST CHEMICAL CO.
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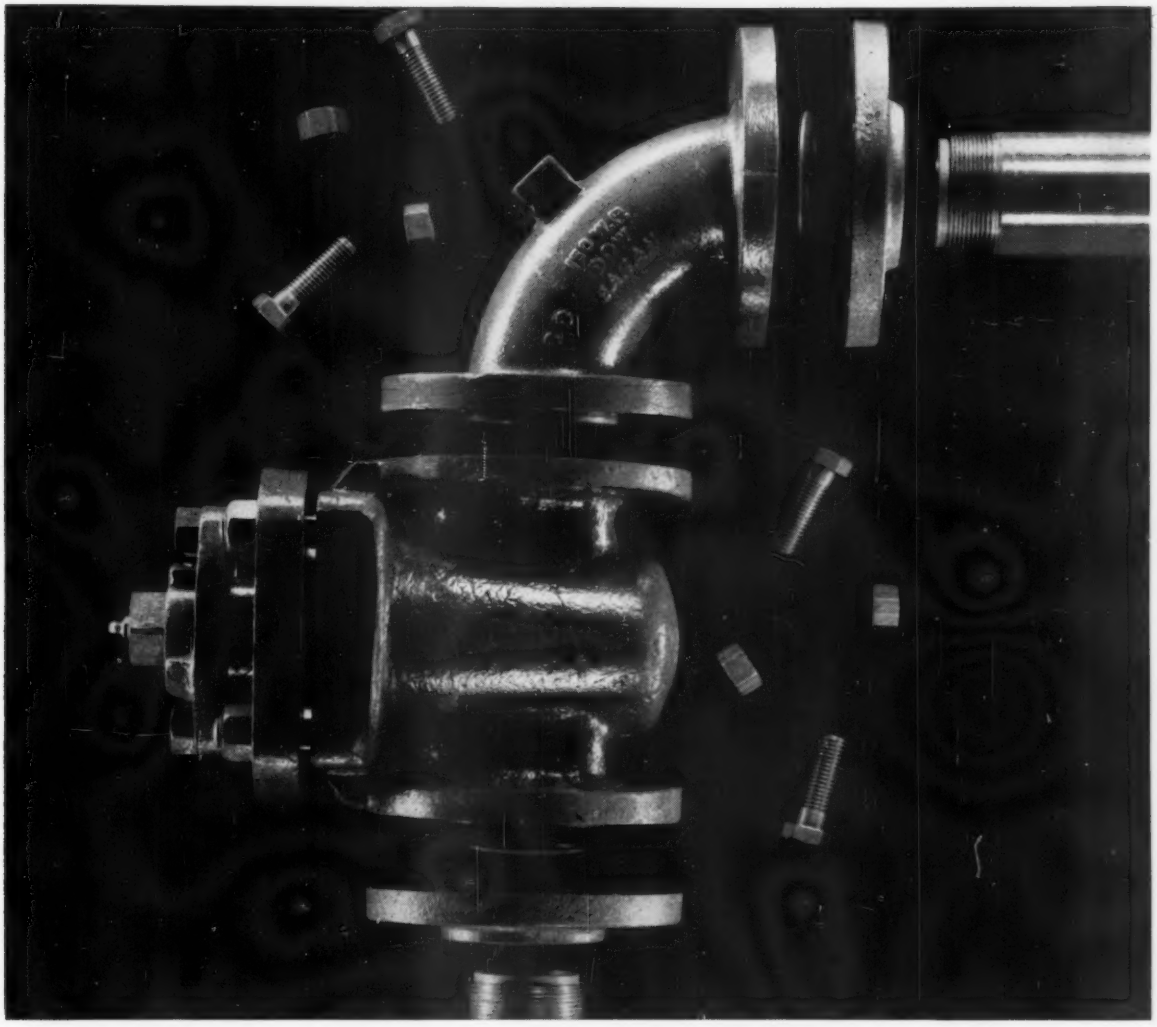

You can see why Saran lined pipe cuts operating costs

These corrosion-resistant pipes, fittings and valves are stock items, and they can be fabricated in the field

The long range economy of Saran lined pipe starts right here—with the immediate availability of pipe, fittings and valves . . . as stock items. There's no waiting . . . no price premium to pay.

And Saran lined pipe can be fabricated in the field. Only conventional hand tools or power equipment are needed to cut and thread it right on the job site.

Saran lined pipe pays off through the years with superior corrosion resistance and strength. When you specify the new gray Saran lined pipe, valves, pumps and fittings, you'll be able to pipe commonly used acids, alkalies and other corrosive liquids under a wider temperature range.

You can plan a *complete* corrosion-free pipe system with Saran lined pipe, valves, pumps and fittings. They're available for systems operating from full vacuum up to 300 psi and temperatures from −20° F to 200° F. Send the coupon today for further information. And be sure to ask about Saraloy® 898 tank lining, too. THE DOW CHEMICAL COMPANY, Midland, Michigan.

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Please send me information on: ☐ Saran lined pipe, fittings and valves ☐ Saran lined centrifugal pumps ☐ Saraloy 898 chemical resistant sheeting

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Address _____ City _____ State _____

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MICCROSOL

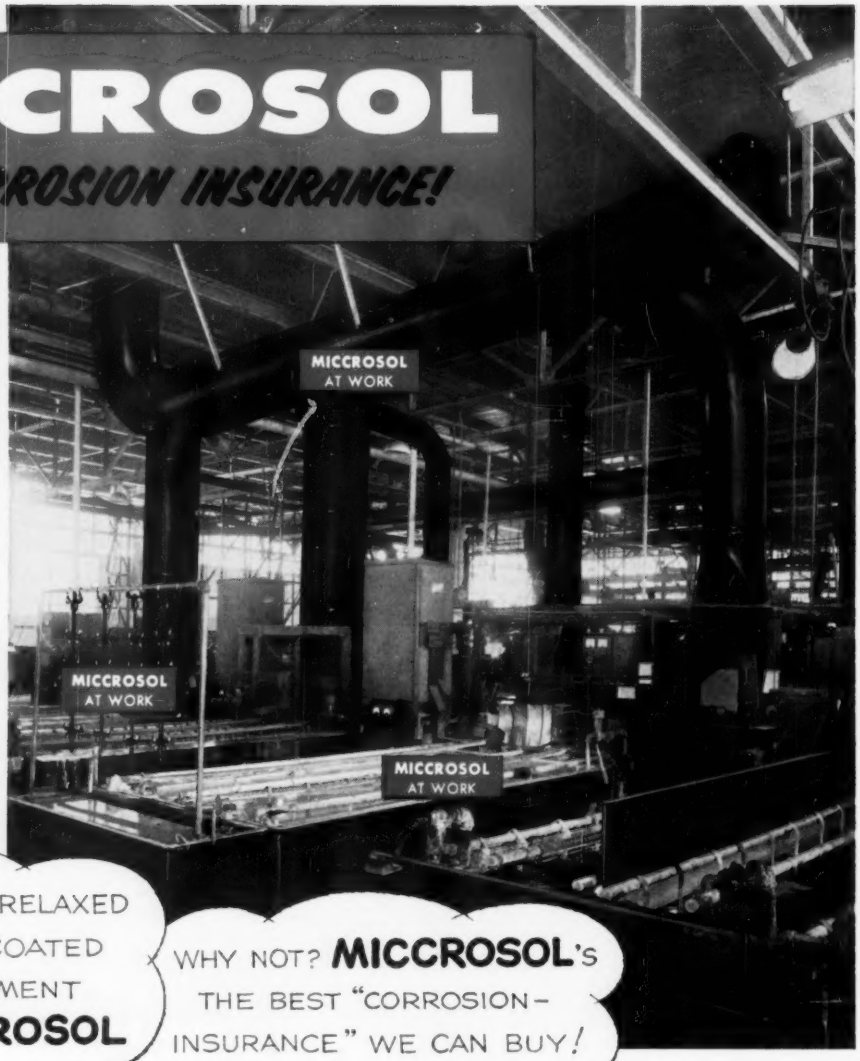
...FOR CORROSION INSURANCE!

for

DUCTS

RACKS

TANKS



HE SURE IS RELAXED SINCE WE COATED OUR EQUIPMENT WITH **MICCROSOL**

WHY NOT? **MICCROSOL**'S THE BEST "CORROSION-INSURANCE" WE CAN BUY!

Long the leading coating for plating racks, Miccrosol has kept pace with corrosion-resistance requirements for other industrial applications.

Famous for its toughness, resilience, abrasion resistance, and flexibility; Miccrosol also has unequalled chemical resistance. Easy to apply and easy to repair; it's available in either *dip* or *spray* formulas.

For the best "corrosion insurance" you can buy . . . use Miccrosol!

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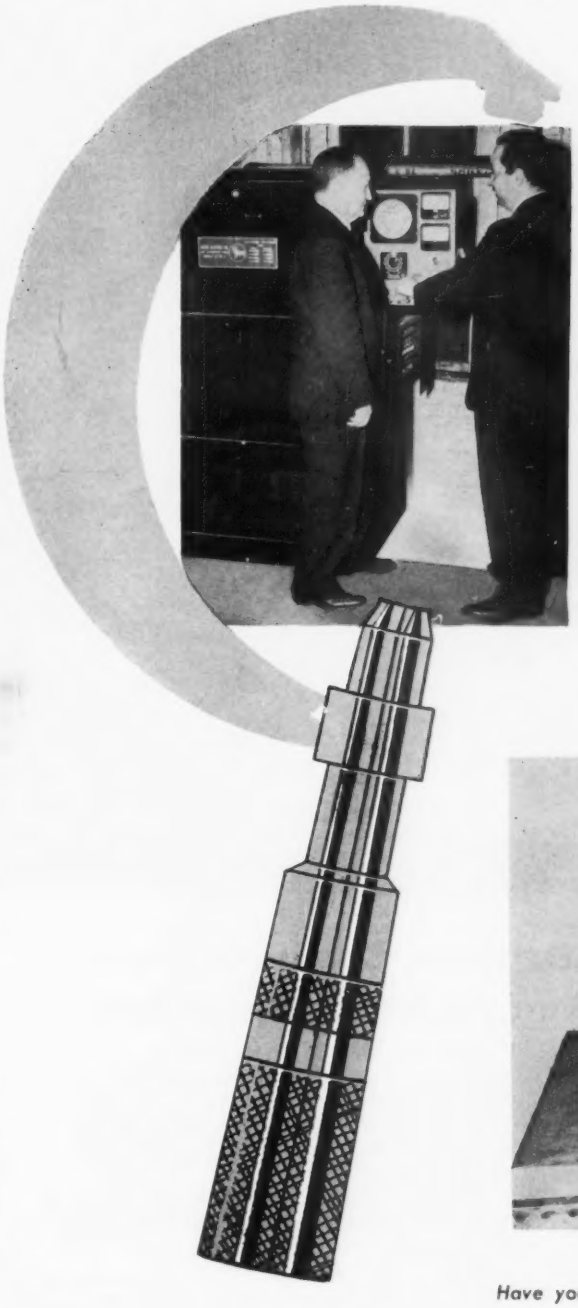
MICRO Products

Developed and manufactured by experienced platers and coaters

FOR TANKS, DUCTS, AND OTHER EQUIPMENT

Accurate Anodizing Company relies on RAPID

automatic rectifier control for precision anodizing . . .



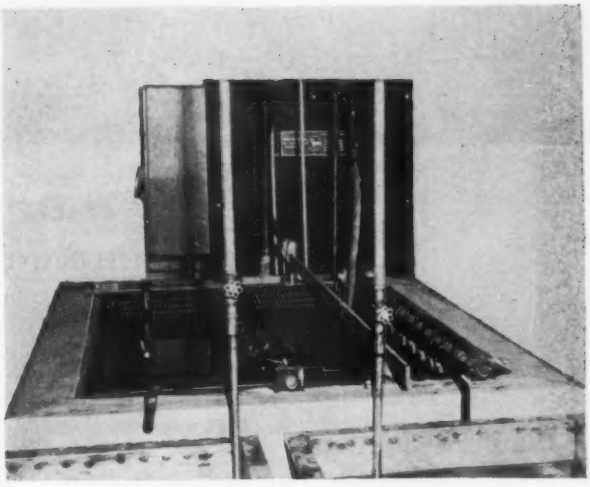
ACCURATE ANODIZING COMPANY of Chicago, Illinois, is a specialist in *Hard Coat Anodizing.

Maintaining a standard of quality indicative of its name is a constant challenge.

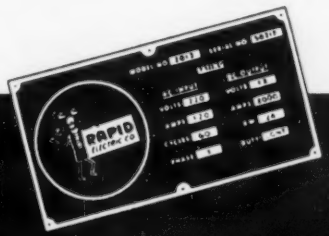
When special rectifying equipment was required to meet extremely critical specifications and close tolerances, A. A.'s staff consulted RAPID engineering specialists.

Recommendations of automatic voltage stabilization and step programming were acted upon. Result: Accurate thicknesses – held to close tolerances – accomplished automatically.

* Patented Process.



Have you a special power requirement?
Professional consultation service available without obligation.
Why not call us to-day?



THE NAMEPLATE THAT MEANS *"More Power to You!"*

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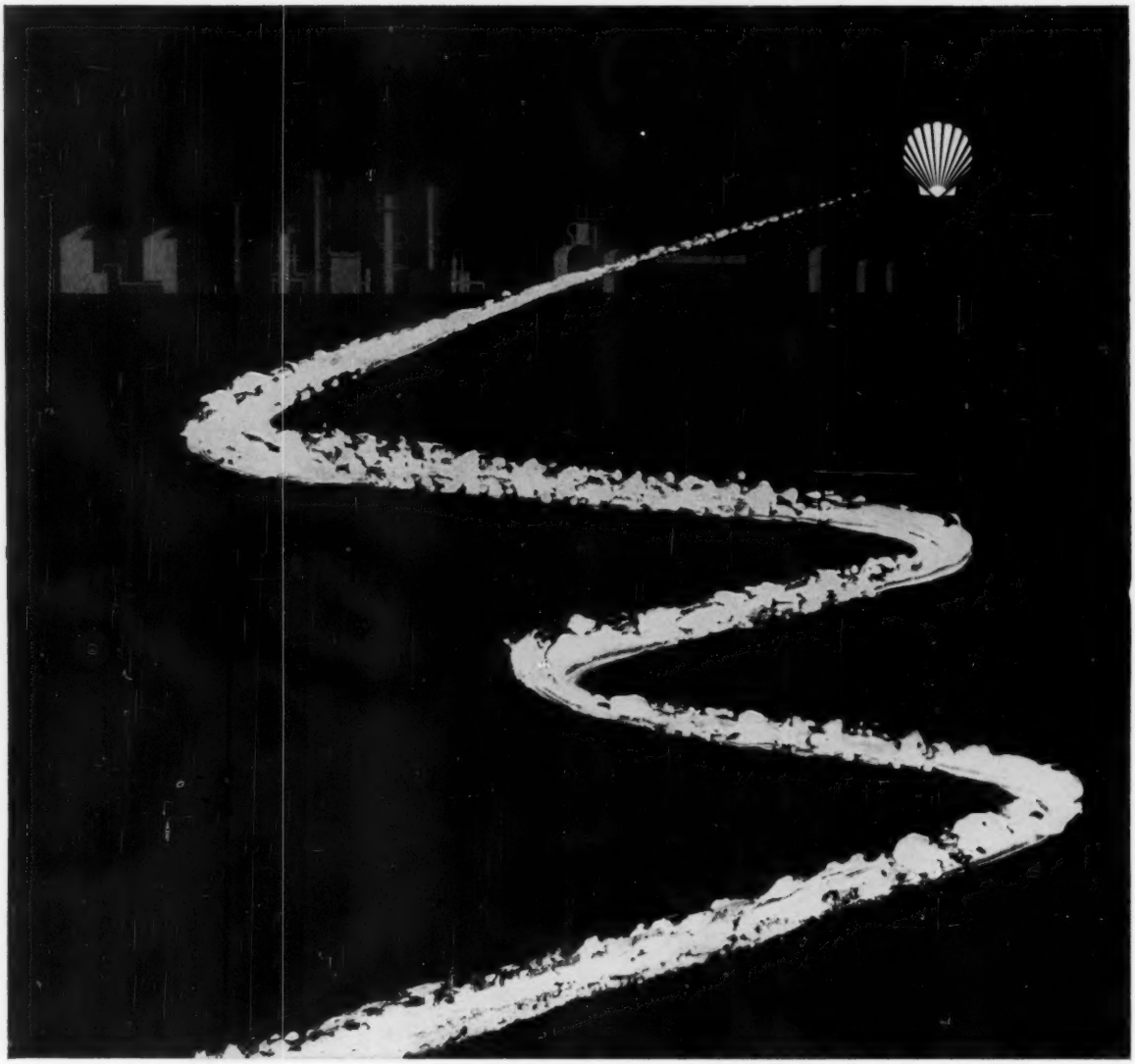

New H_2O_2 Shell Chemical Plant now on stream At Norco, Louisiana

With a multi-million pound capacity, this new Shell Chemical plant now takes its place as an important source of high-purity hydrogen peroxide.

Deliveries are now being made from Norco in drum to tank-car quantities.

To help you with your H_2O_2 application and handling problems, Shell Chemical maintains a very active research program and a field service to render expert technical assistance to processors. As a major consumer of hydrogen peroxide, Shell has acquired extensive experience in the special problems of H_2O_2 chemistry.

Your Shell Chemical representative will be glad to consult with you on your own H_2O_2 requirements.

Write to:

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION

Atlanta • Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Newark • New York • San Francisco • St. Louis

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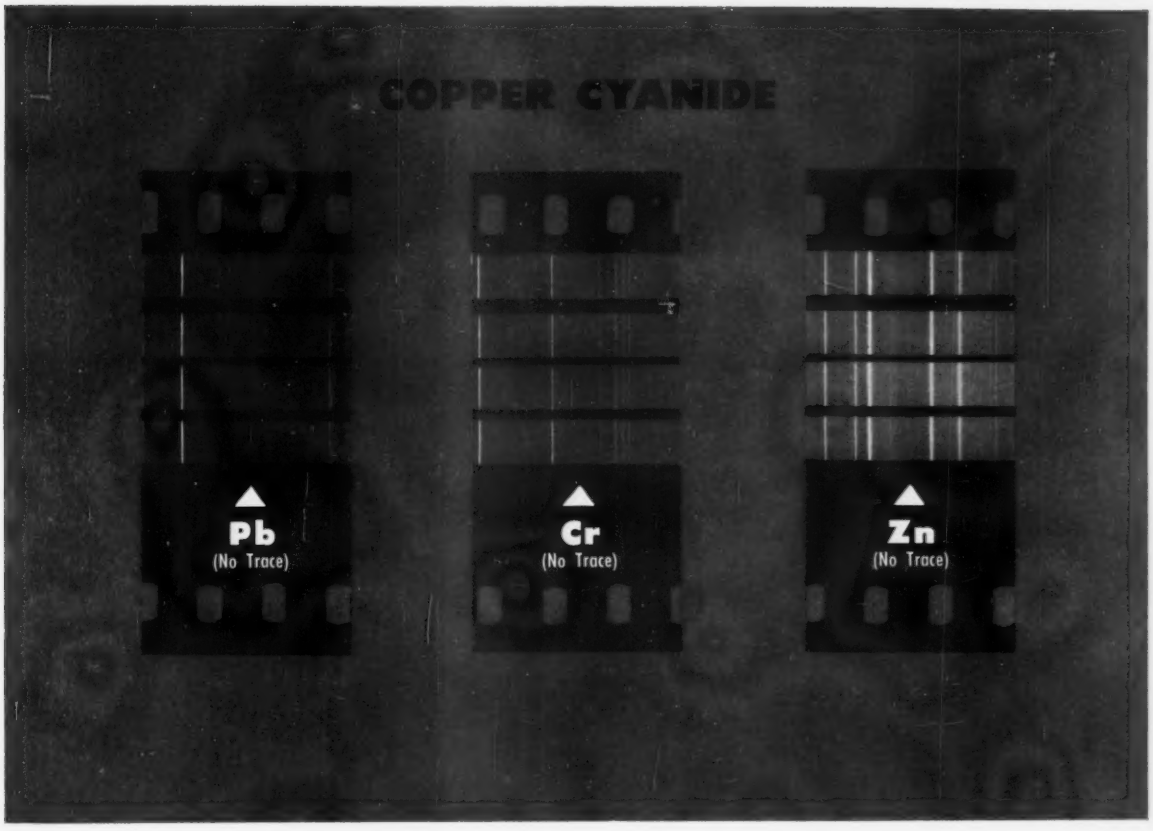
SHELL



Spectrographic Analysis PROVES CP's Copper Cyanide CONSISTENTLY Free From Impurities

Whenever you use CP's Copper Cyanide you can be *sure* of its purity and dependability . . . because every batch is carefully tested.

The photographs above illustrate the absence of any trace of lead, zinc or chromium. This film record is typical. In addition, our Copper Cyanide is completely free of sulphur or organic contamination. In tests run on production samples over an 18 month period, no deviation in purity was noted. The quality of all our products is constantly checked both by spectrographic analysis and under actual working conditions. Our own findings are confirmed by tests on a typical production sample by an independent laboratory, Ledoux & Company.

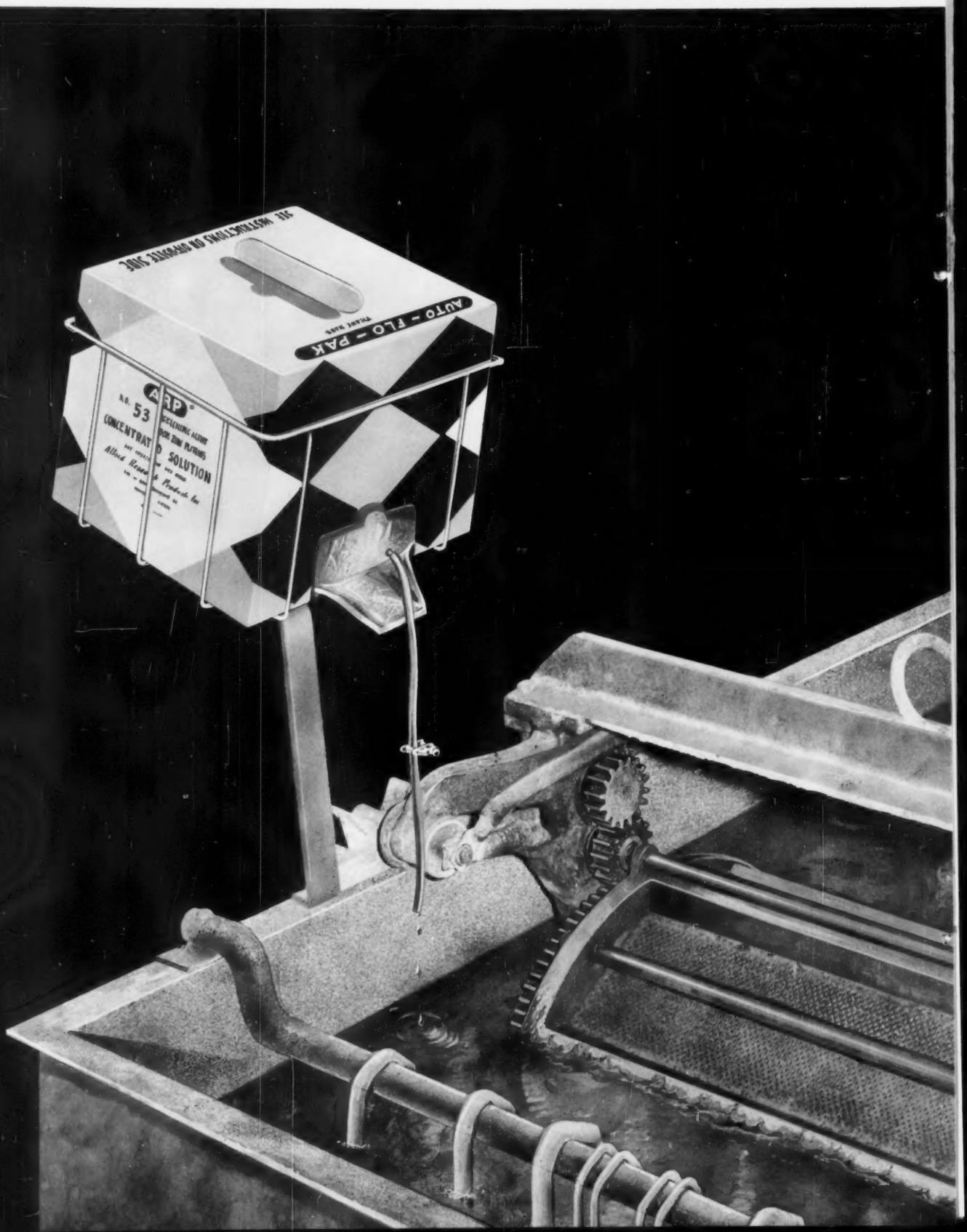
As domestic producers, we offer reliability of source, through conveniently located distributors.

Investigate the advantages of CP's Copper Cyanide. We will be happy to send you a copy of the Ledoux & Company Analysis Report and a sample for your own testing, without obligation of course.

CP COPPER PIGMENT & CHEMICAL WORKS, INC.

217 BAYWAY, ELIZABETH 2, NEW JERSEY

NOW, GET DIAMOND-BRIGHT ZINC



& CADMIUM PLATING *Easier with*

1—Revolutionary AUTO-FLO-PAK for Liquid Brighteners

TRADE MARK

Provides accurate, steady, automatic feed for more uniform plating, lower plating costs. When used with easy-to-set-up Auto-Flo Dispenser, you get:

AUTOMATIC MAINTENANCE OF PROPER BRIGHTENER LEVEL—This amazing AUTO-FLO-PAK and new brightener dispensing method require only a single setting to assure a constant, peak-efficiency, uniform flow of brightener. There's no danger of adding too little or too much . . . no waste, no muss, no bother.

MORE UNIFORM BRIGHTNESS, MORE UNIFORM PLATE—Each part you plate gets the full effect of brightener as it is fed into the solution . . . helps produce a uniform, diamond-bright plate throughout the entire run.

The AUTO-FLO-PAK consists of a specially designed one-gallon polyethylene container in a cardboard carton. It is designed for use in conjunction with the Auto-Flo Dispenser, consisting of a wire mounting rack and feed tube. The Auto-Flo Dispenser is available from Allied. For those who prefer to pour a specified amount of liquid brightener into the plating solution, the AUTO-FLO-PAK has a handy pouring spout on the top and a measuring window on the side.

The ready-to-use AUTO-FLO-PAK, 6 to a case, is easier to handle and gives better inventory control. You can tell at a glance what you have in stock . . . and you release just the right amount to your production line. The AUTO-FLO-PAK takes up less storage space and can be easily lifted on and off shelves.

The Auto-Flo Dispenser with the adjustable feed tube assembly provides absolute and positive brightener flow control. Once you set it, you forget it . . . and you automatically and constantly get maximum brightness, efficiency and economy. There's little chance of wasting any brightener. The Auto-Flo Dispenser is easily attached to any tank . . . does not interfere with plating operations.

2—New, Low-Cost ARP® #53 Liquid Brightener

A great new Liquid Barrel Zinc Brightener that gives you:

LOWER PLATING COSTS—ARP 53 is not only low in purchase price but low in operating costs.

LONGER LIFE—ARP 53 has excellent stability at high temperatures . . . also after shut-downs of the plating bath.

DIAMOND-BRIGHT FINISH—ARP 53 gives bright plate over a wide range of current densities in barrel plating. ARP 53 maintains excellent throwing power and reaches deep recesses easily with uniformly bright deposits . . . provides ideal plated surface for clear bright or colored Iridite coatings.

EASE OF USE—Like all ARP brighteners, ARP 53 is 100% organic in nature, easy to put into use and gives immediate results.

MORE GOOD NEWS FOR ZINC AND CADMIUM PLATERS!

ARP 31 for rack zinc plating and ARP 41 for all cadmium plating are also available in the convenient new AUTO-FLO-PAK . . . at slightly higher prices to cover special packaging.

SPECIAL INTRODUCTORY OFFER!

As a special introductory offer, we'll send you one Auto-Flo Dispenser at a special price of $4.40 with your first order for ARP 53, ARP 31 or ARP 41 in the AUTO-FLO-PAK, 6 to a case. Additional Auto-Flo Dispensers are available at regular price of $8.80. This offer expires MAY 31, 1958, so clip coupon, fill out and mail today.

PLEASE SEND ME:

_____cases of ARP 53 (9 lbs. per AUTO-FLO-PAK) @ $ .75 lb. $40.50 per case.

_____cases of ARP 31 (10 lbs. per AUTO-FLO-PAK) @ $1.02 lb. $61.20 per case.

_____cases of ARP 41 (8 lbs. per AUTO-FLO PAK) @ $ .64 lb. $30.72 per case.

_____also send me Auto-Flo Dispensers at $4.40 each.

_____I would like more information of ARP # _____ and the AUTO-FLO-PAK.

NOTE: *Special price on Auto-Flo Dispenser applies only to the first case order on each brightener.*

Please send me_____extra Auto-Flo Dispensers at $8.80 each.

COMPANY_____

STREET_____

CITY_____ **ZONE**_____ **STATE**_____

Order Authorized by_____

Allied Research Products, Incorporated

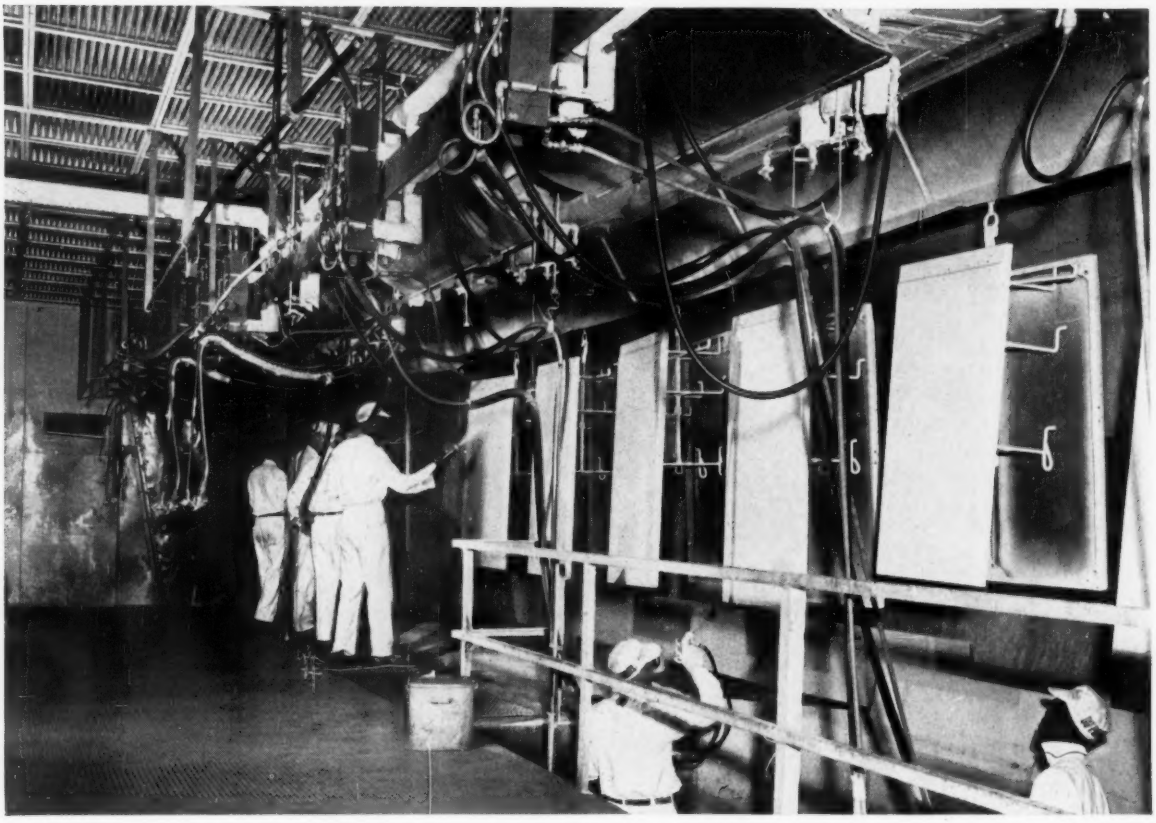
4004-06 E. MONUMENT STREET BALTIMORE 5, MARYLAND

Manufacturers of

Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals

West Coast Licensee—L. H. Butcher Co.

$75,000 SAVED BY DEVILBISS HOT SPRAY



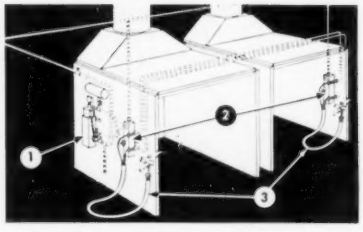
Refrigerator doors are sprayed in DeVilbiss water-wash spray booth—one of eight such booths in this modern plant. A battery of DeVilbiss remote paint heaters serves the line; each station is equipped with two DeVilbiss heat exchangers and spray guns.

One of the world's largest appliance manufacturers has experienced important material savings as a result of a DeVilbiss hot-spray installation in its Midwest plant.

Although this equipment has been in operation less than two years, the company reports an estimated reduction in primer and enamel consumption of 10% to 15% compared to former cold-spray methods—a saving of about $75,000 annually! What's more, where spray booths once required cleaning 13 times a year, this has now been reduced to only 3 times a year—due to the reduction of spray fog.

Perhaps you, too, can profit from DeVilbiss hot spray. This method offers smoother finishes with less shrinkage; heavier film build; faster drying; and lower spraying pressure with minimum overspray!

Call your nearest DeVilbiss branch office today for complete details. Or write direct.



DeVilbiss hot-spray system is foolproof; adapts to multiple gun hook-ups. Hot water from master heater ① heats paint in exchangers ②; heat-jacketed hose assemblies ③ keep paint hot right up to guns, assuring uniform viscosity at all times at each gun.

FOR BETTER SERVICE, BUY

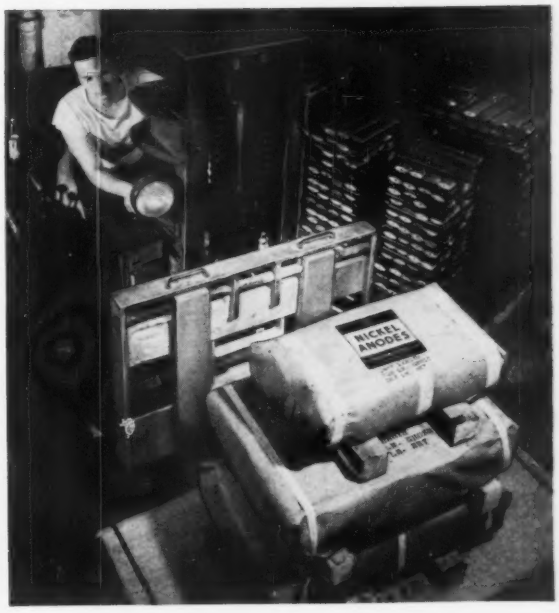
DEVILBISS

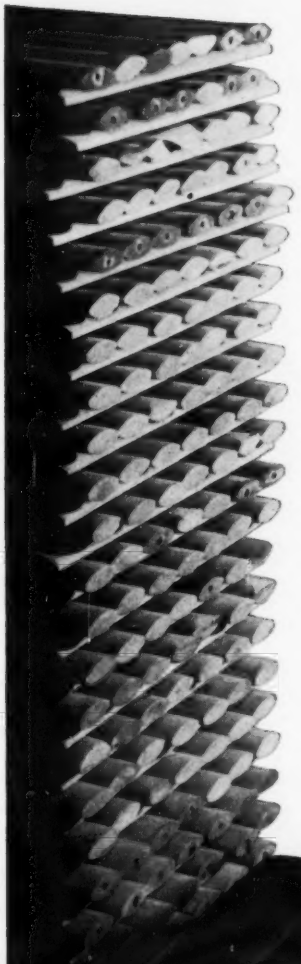
THE DEVILBISS COMPANY, TOLEDO 1, OHIO

Barrie, Ontario • London, England • Offices in Principal Cities

Prompt Delivery of any Quantity

HARSHAW
Nickel Anodes
99+%





HARSHAW XXX CAST CARBON NICKEL ANODES are oval 1½" x 3" in cross section and are available in any length desired. Weight is approximately 1.1 lbs. per linear inch. They are normally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL CARBONIZED NICKEL ANODES are 1¼" x 3" in cross section and are available in any length desired. Weight is approximately 1 lb. per linear inch. They are generally used in dull, semi bright and bright nickel plating baths where the pH is 4.5 or lower.

HARSHAW ROLLED OVAL DEPOLARIZED NICKEL ANODES have the same cross section and weight as the rolled oval carbonized nickel anode and are also available in any length desired. These anodes are generally used in nickel plating baths where the pH is 4.0 or higher; they are extremely suitable for such use, as they will corrode well over a wide range of operating conditions.

PACKAGES

Harshaw anodes are wrapped in a fibre reinforced laminated (without asphalt) paper. They are protected from tramp oils, dirt and grease and remain clean until used. The possibility of such contaminents being introduced into the plating solution from anodes is thus kept to a minimum.

Harshaw anodes are shipped in compact packages which feature built-in skids and facilitate quick handling by mechanical or hand trucks. The packages stack easily and quickly. Also, no deposits or returnables are involved with this type of packaging.

Harshaw Nickel Anodes are readily available and prompt shipment of any quantity will be made upon receipt of your order.

HARSHAW

Recasting Service

Our foundry facilities are available for recasting nickel anode scrap. Contact your nearest Harshaw Branch for further details.

THE HARSHAW CHEMICAL COMPANY

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DETROIT, MICH. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
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PITTSBURGH, PENNSYLVANIA

NEW FROM UDYLITE - THE SILICON RECTIFIER

Efficiency—Flexibility—
The Longest Life, Ever!

You get all these advantages, and more, with a UDYSIL Rectifier! Silicon, the amazing long life element, combined with a new, revolutionary BALANCED circuit, makes the Udysil line the most advanced series of plating rectifiers ever developed! Only UDYSIL gives you . . .

★ **UNLIMITED CELL LIFE** — The amazing element Silicon assures you the longest life ever for a plating rectifier. Hermetically sealed, the cells won't "age" . . . can't ever wear out!

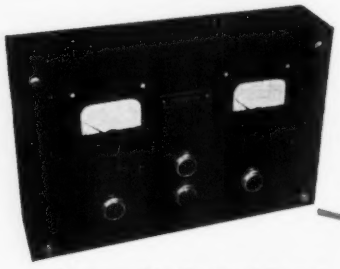
★ **UNEQUALED DEPENDABILITY** — The new BALANCED circuit power means no more "blowing" of stacks through uneven cell loading — no more complex individual cell protection devices — no more ruined parts and loss of production from a shut down rectifier.

★ **UNAFFECTED BY HIGH TEMPERATURES** Inducted cooling is employed to obtain 1000 to 1200 feet of ventilation through the stacks—allows high temperature operation. UDYSIL rectifiers can now operate at full work load even in room temperatures up to 120° F. with no reduction in efficiency, voltage or cell life!

★ **UNIMPEDED APPLICATION** — UDYSIL can be used in any plating bath, it has a 4.2 ripple factor over the entire voltage range. Complete variety of voltage and ampere capacities available (see specifications).

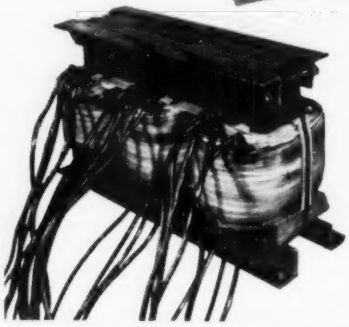
★ **UNSURPASSED ECONOMY** — UDYSIL offers you economy *two* ways. With a power factor of 92%, your installation costs are low, no more paying for wiring that you don't need. And, with UDYSIL's exceptionally high efficiency you save on operating expenses!

All these *exclusive* advantages are yours when you select UDYSIL. In addition, all transformers contain high quality, glass-wound insulation for maximum protection against moisture and chemical attack. Now, here's the inside story on UDYSIL!



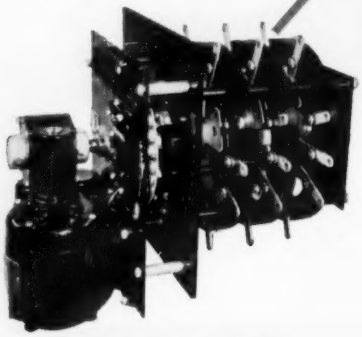
Removable Control Panel

Here's the removable control panel that can be retained on the front of the rectifier or mounted remotely anywhere in your shop. Big, easy-to-read dials give you a quick visual check on performance.



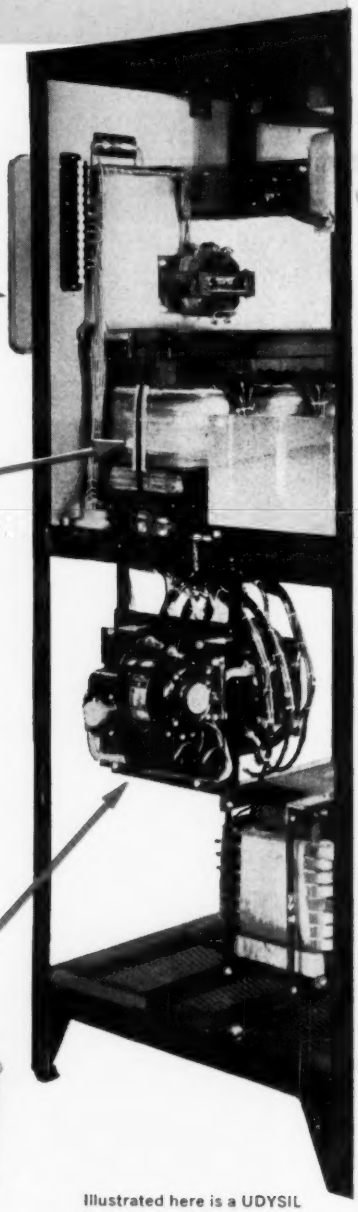
Regulator Transformer

A familiar item on all Udylite rectifiers, this transformer assures you proper voltage and current regulation when you need it. UDYSIL is also available without regulation, if preferred.



Motor Driven Tap Switch

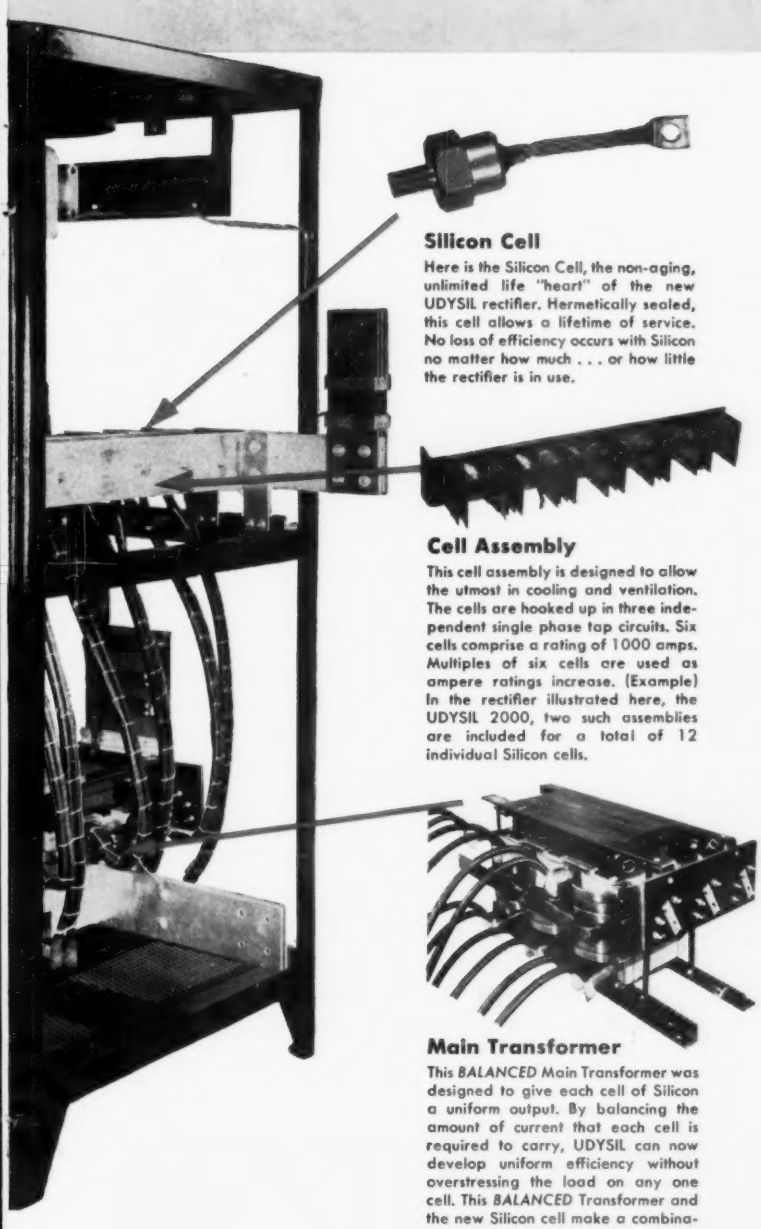
UDYSIL rectifiers are available either with this motor driven tap switch or a manual integral unit. Eight taps per phase allow 22 steps of regulation over the D.C. voltage range.



Illustrated here is a UDYSIL 2000 Ampere Rectifier.

UDYSIL

WITH BALANCED POWER



Silicon Cell

Here is the Silicon Cell, the non-aging, unlimited life "heart" of the new UDYSIL rectifier. Hermetically sealed, this cell allows a lifetime of service. No loss of efficiency occurs with Silicon no matter how much . . . or how little the rectifier is in use.

Cell Assembly

This cell assembly is designed to allow the utmost in cooling and ventilation. The cells are hooked up in three independent single phase tap circuits. Six cells comprise a rating of 1000 amps. Multiples of six cells are used as ampere ratings increase. (Example) In the rectifier illustrated here, the UDYSIL 2000, two such assemblies are included for a total of 12 individual Silicon cells.

Main Transformer

This *BALANCED* Main Transformer was designed to give each cell of Silicon a uniform output. By balancing the amount of current that each cell is required to carry, UDYSIL can now develop uniform efficiency without overstressing the load on any one cell. This *BALANCED* Transformer and the new Silicon cell make a combination that is unbeatable for long life and high efficiency.

Udysil is available with optional features
. . . to meet your every operating need exactly!

- ★ Equipment can be supplied for any degree of voltage control. A vernier can be added to provide control steps intermediate to those of the tap switch.
- ★ Induction regulator for high current requirements.
- ★ Constant voltage control
- ★ Constant current control
- ★ Constant average current density control
- ★ Automatic programming

SPECIFICATIONS

AMPERE CAPACITY	VOLTAGE CAPACITY	KVA CAPACITY
1000	6	8.6
1000	9	13.0
1000	12	16.0
1000	18	24.0
1000	24	30.0
1500	6	13.0
1500	9	19.0
1500	12	24.0
1500	18	36.0
1500	24	45.0
2000	6	17.0
2000	9	26.0
2000	12	32.0
2000	18	48.0
2000	24	60.0
3000	6	26.0
3000	9	39.0
3000	12	48.0
3000	18	72.0
4000	6	34.0
4000	9	52.0
4000	12	64.0
5000	6	43.0
5000	9	65.0
6000	6	52.0
6000	9	78.0

Additional capacities are available on request.

the udylite corporation

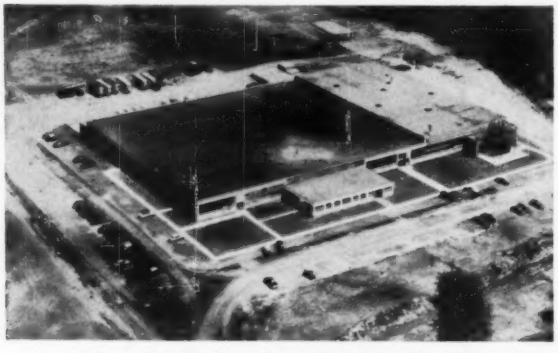
detroit 11, michigan • world's largest plating supplier

$2,000 a Month Saved By Channel Master!

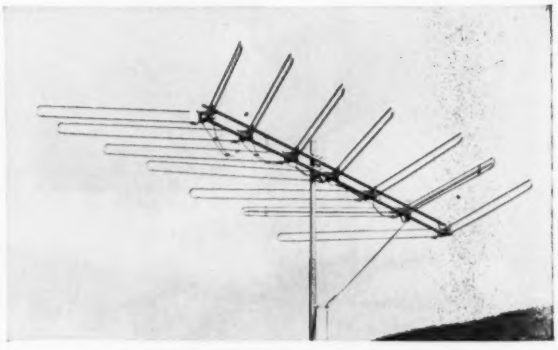
By Using Ion Exchange To Purify Chromic Acid Bright Dip

Channel Master Corp., of Ellenville, N. Y., is the world's largest manufacturer of television antennas and accessories. One important reason for this leading position in a new and highly competitive field is the extremely high quality they have set for all their products.

One of these standards requires that the antenna withstand the corrosive effects of weather during its years of service. Although the antennas are primarily made of aluminum, steel clamps used in assembly can be affected by weather. In order to protect these steel parts and other vital accessories, such as mounting brackets and insulating hardware, from corrosion, they are first zinc plated and then dipped in a chromic acid type bath and sent through rinsing and bleaching baths to give them a bright finish. The bright dip bath loses its bite rapidly — affecting quality and requiring either discharge or treatment.



Channel Master's modern plant located in the heart of New York's resort area



Channel Master TW fringe area antenna.

Channel Master thoroughly investigated all known methods of treatment to find the one most suitable for their needs. They finally chose a Graver Ion Exchange system tailored to fit into the overall plating operation. This system restores the original bath quality and eliminates bath dumping. The equipment has now been in operation for over two years.

Results

- $2,000 a month saved by Channel Master using Graver Ion Exchange
- Difficult waste disposal problem solved
- Better rinsing from demineralized water

Write for Technical Reprint T-143 describing the operation of above system and Bulletin WC-111 describing Graver Ion Exchange Systems.

GRAVER

Industrial Waste Dept. W-511

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 West 14th Street, New York 11, N. Y.

FOR BRIGHT ZINC LIKE THIS . . .

Only *Dual Action* ISO-BRITE® ZB567

Rustproofing, Inc., President, Angelo Melone says: "Our automotive customers demand top quality brightness. ZB567 gives us an outstanding finish and enables us to meet competition and make a fair profit, too."

- PRODUCES FULL BRIGHTNESS
- COST LESS PER POUND
- STANDS UP LONGER

and

PERFORMS EQUALLY WELL IN BOTH BARREL AND RACK PLATING

Substantial benefits for the plating plant and its customers! That's just what the record shows for Wagner's new Iso-Brite ZB567® and until you get an opportunity to prove our claims in your own tanks, be guided by the experience of a progressive plating plant which has used Iso-Brite ZB567 for many months:

Rustproofing, Inc., Detroit, now uses Iso-Brite ZB567 exclusively for both its lines—barrel and rack—thus reducing inventory greatly. The cost is appreciably less than their former additive which, however, could not be used successfully in both lines. Also according to Angelo Melone, Rustproofing president, less additive is required to achieve high quality brightness and only small daily additions are needed to maintain full efficiency. In addition, Rustproofing's freight charges are nil since the Wagner warehouses are located close to the centers of mass production. And perhaps above all, Rustproofing keeps its many customers completely satisfied with the fully bright finish they specify; day to day reliability of ZB567 has reduced rejects to an insignificant minimum.

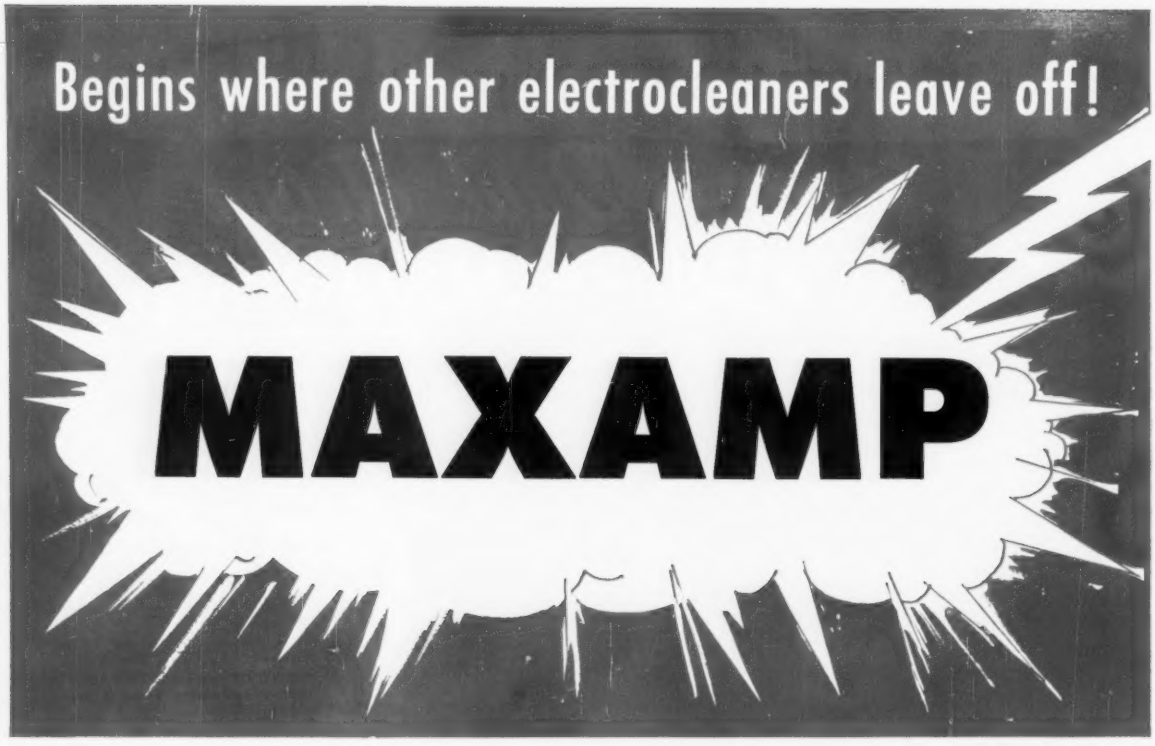
If your production requires the protection of zinc plating, plus the appeal of an attractive, bright finish, you're money and customer satisfaction ahead when there's Iso-Brite ZB567 in the tanks. If you're handling small "bulk" parts which must be barrel plated, you're doubly rewarded by the simplified inventory and low costs of this two-fisted new additive. Now—when increased operating efficiencies offer the only remaining opportunity for meeting and beating competition—investigate this vital Wagner Brothers development. For full information on Iso-Brite ZB567 and the entire Wagner electroplating line of equipment, anodes, chemicals and other supplies, call our representative in your area. He'll be glad to assist you with all plating department problems.

MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

400 MIDLAND AVE., DETROIT 3, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • SYRACUSE • GRAND RAPIDS

Wagner BROTHERS INC.



Wyandotte's amazing new development for steel electrocleaning!

Never before an electrocleaner like this! New MAXAMP delivers a new high in performance; brings you outstanding efficiencies never before possible.

MAXAMP's new and greater conductivity and maximum detergency handle those really tough jobs: stubborn smut, buffing and polishing compounds; phosphate coatings from drawing operations. Cleaning results are remarkable — your plating is mirror bright and stain free!

MAXAMP gives unequaled performance in handlines and automatics. Also important: MAXAMP is anhydrous, which means you buy *all cleaner*, no built-in water. Gives maximum results with minimum concentrations. And there's ideal foam control—no explosions, yet keeps fumes from escaping.

So, if you're interested in more efficient electrocleaning operations—and who isn't?—it'll pay you to investigate MAXAMP. It's the "new king of steel electrocleaners!" Call your Wyandotte representative for a demonstration, today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

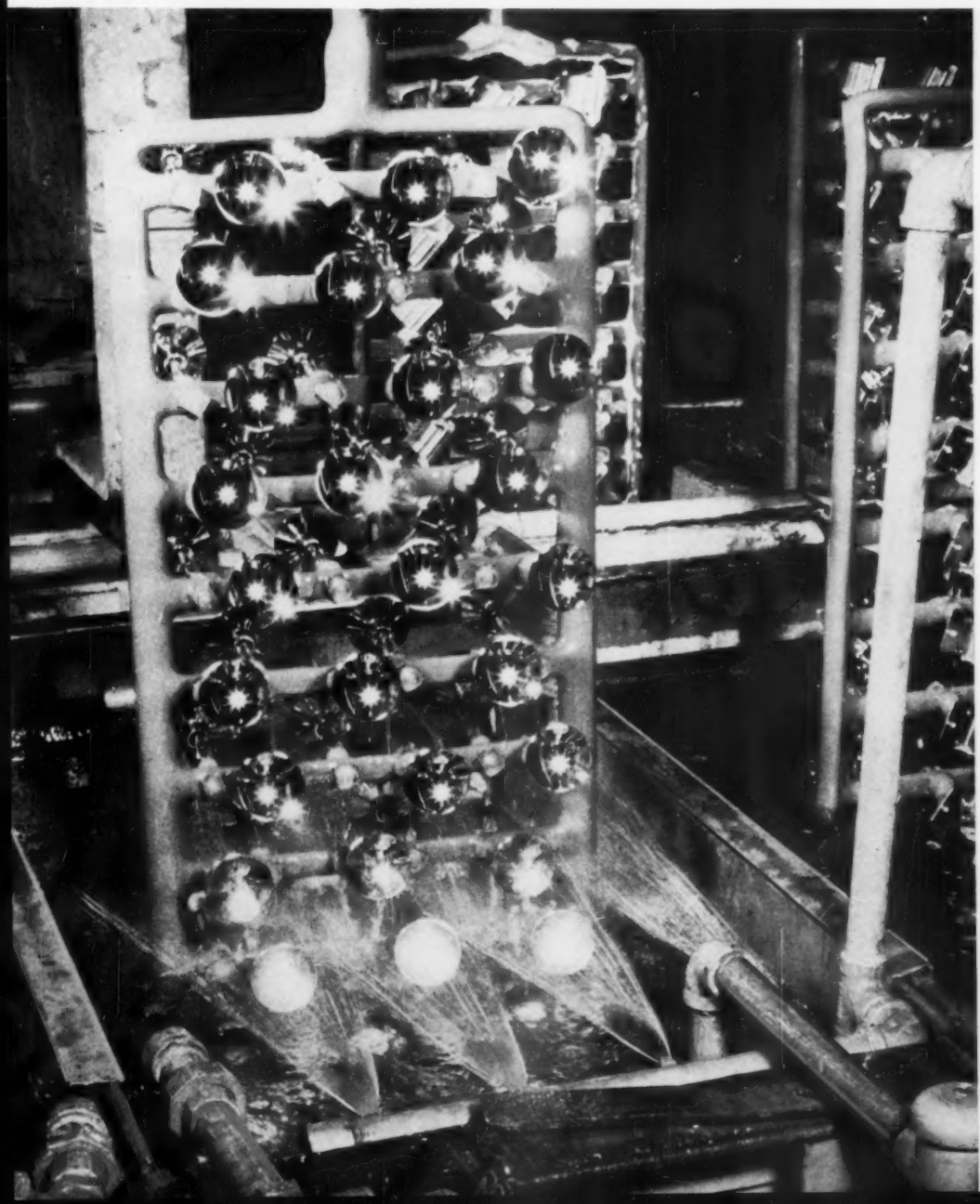
Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

Get the extras that cut costs and guarantee consistent results... Competitively tested materials, comprehensively and conscientiously serviced by a nationwide network of sales engineers and distributors. Federated's materials include new ASARCO-CAST COPPER anode, triple-life Conducta-Core lead anode, copper, zinc, tin, tin-lead, cadmium, brass and silver anodes. Nickel salts. Zimax, Nimax, Cadmax brighteners. New Conmax conversion coatings for zinc, nickel and cadmium plated parts. Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF



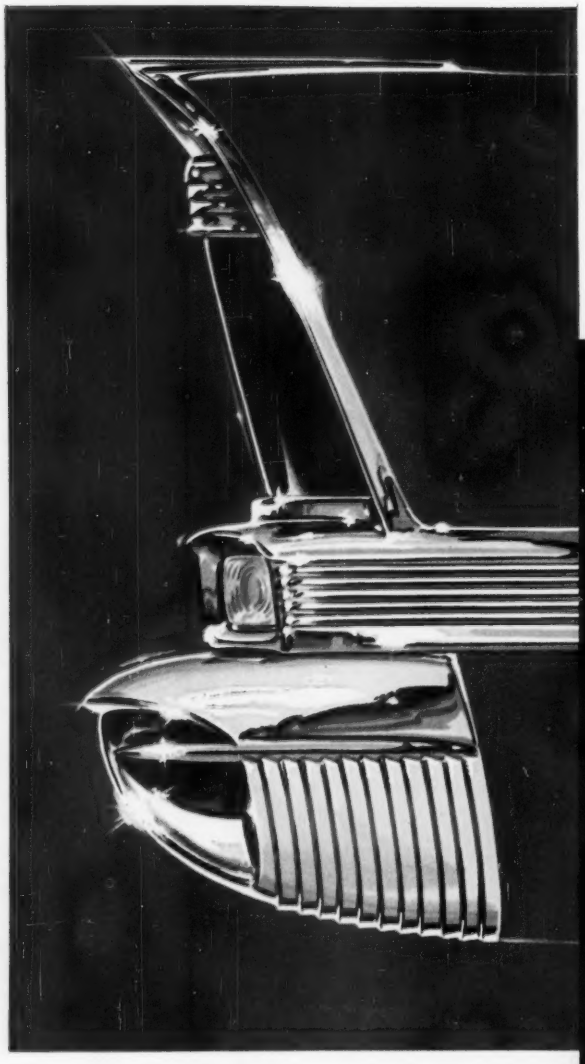
ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Regardless of part size or quantity—

Acme

CAN SOLVE YOUR

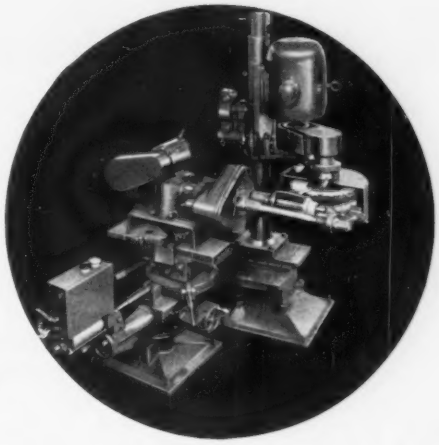


in almost any shape—

FINISHING PROBLEM AUTOMATICALLY!

Because Acme engineers have designed and produced polishing and buffing machinery since 1910 . . . because, for 47 years, they have created automatic setups for constantly changing products—Acme engineers have a wealth of experience which can be profitably applied to your polishing operations, big or little.

Acme offers a full range of equipment to give you efficient production on almost anything which needs polishing, buffing, grinding, deburring or micro-finishing. Above, the flexible G-4 lathe, often part of a complex automated setup with controls, conveyors—other auxiliaries. Below, one of our many semi-automatic machines for simpler finishing problems.



Turn over to them your current problem. They will combine standard Acme units and accessories with the work-holders or fixtures necessary to give you a custom setup for low-cost, high-volume production. And the same versatile Acme machines may be quickly and easily adapted to meet next year's challenge, too!

Whenever polishing or buffing is involved in your production, ask for the advice of an Acme engineer, a skilled specialist. There's no obligation, naturally, and he will give you practical recommendations designed to meet your specific needs.

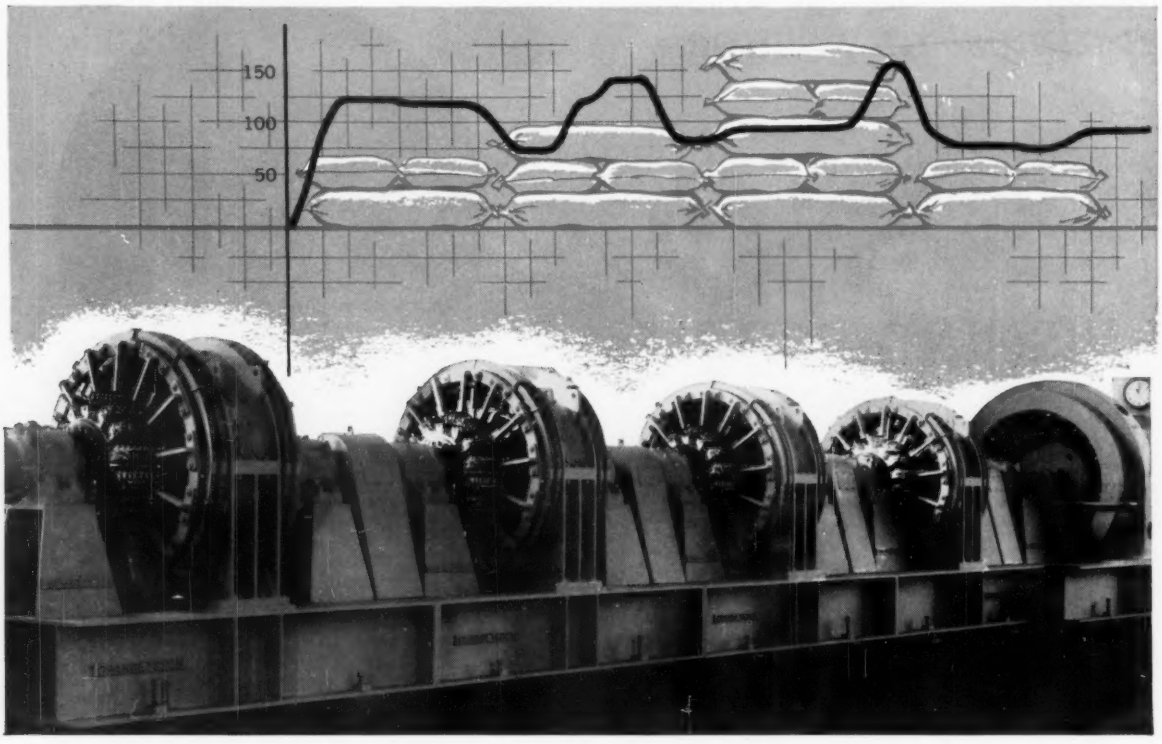
LET ACME *Polish Off*
YOUR FINISHING PROBLEMS

ACME MANUFACTURING COMPANY

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

LEADING PRODUCERS OF AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

EXTRA **stamina**...WHEN YOU NEED IT MOST



...PROOF THAT MOTOR GENERATORS ARE YOUR MOST DURABLE FORM OF POWER CONVERSION

Chandeysson **generators are built with high overload capacity—up to 50% momentarily**

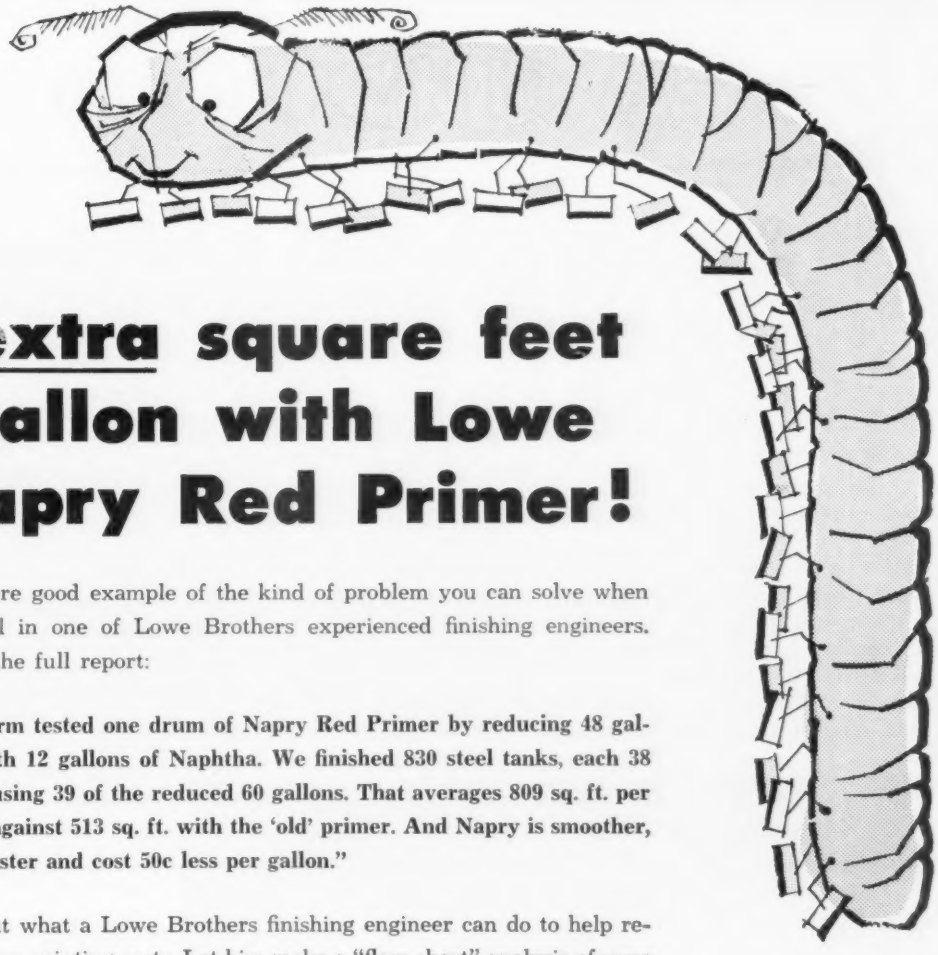
Stamina and durability are built right into Chandeysson Motor Generators to give you more power when you need it most . . . in an emergency. You get overload capacity as great as 50% momentarily and 25% for 2-hour periods . . . without distress or damage. All *this* is the result of Chandeysson's sound engineering, painstaking design, specialized craftsmanship, and thorough testing.

Stamina is just one of many reasons why the plating industry *insists* on Chandeysson low-voltage generators for direct current power needs . . . for extra capacity to meet emergencies at the lowest possible cost.

For full information, write now for new booklet D-103.

CHANDEYSSON ELECTRIC COMPANY

4074 Bingham Avenue • St. Louis 16, Missouri



296 extra square feet per gallon with Lowe Napry Red Primer!

One more good example of the kind of problem you can solve when you call in one of Lowe Brothers experienced finishing engineers. Here's the full report:

"This firm tested one drum of Napry Red Primer by reducing 48 gallons with 12 gallons of Naphtha. We finished 830 steel tanks, each 38 sq. ft., using 39 of the reduced 60 gallons. That averages 809 sq. ft. per gallon against 513 sq. ft. with the 'old' primer. And Napry is smoother, dried faster and cost 50c less per gallon."

Find out what a Lowe Brothers finishing engineer can do to help reduce your painting costs. Let him make a "flow-chart" analysis of your finishing system *without* obligation. Send the coupon right now.

LOWE BROTHERS
INDUSTRIAL FINISHES
QUALITY UNSURPASSED SINCE 1870

Style-tested paints for Home and Industry

REPRESENTATIVES IN: Chicago, Ill. • Boston, Mass. • Jersey City, N. J. • Cleveland, Ohio • Pittsburgh, Pa. • Rochester, N. Y. • Dayton, Ohio • Columbus, Ohio • Milwaukee, Wis. • Indianapolis, Ind. • Cincinnati, Ohio • Detroit, Mich. • Springfield, Mass. • Philadelphia, Pa.

The Lowe Brothers Company MF-4
Dayton 2, Ohio

☐ Please have my nearest Lowe Brothers Finishing Engineer call on me as soon as possible.

NAME_____

TITLE_____

FIRM NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

DU PONT REG. U. S. PAT. OFF. *PRODUCT NEWS*

Save time, avoid errors in bath make-up and replenishment with Du Pont's new sodium-copper cyanide double salt

Sodium-copper cyanide double salt has been developed by Du Pont to give copper platers a fast-dissolving, tailor-made plating chemical. It's a white, crystalline salt that combines high-quality Du Pont Cyanobrik® Sodium Cyanide and Copper Cyanide into *one* convenient copper-plating chemical for both bath make-up and replenishment.

You'll find these advantages in this new, easy to use sodium-copper cyanide double salt:

Time Saved—This convenient plating chemical eliminates time spent in weighing out sodium cyanide and copper cyanide separately. It dissolves readily in water or plating solution without the evolution of heat . . . cutting out several steps required to dissolve copper cyanide properly.

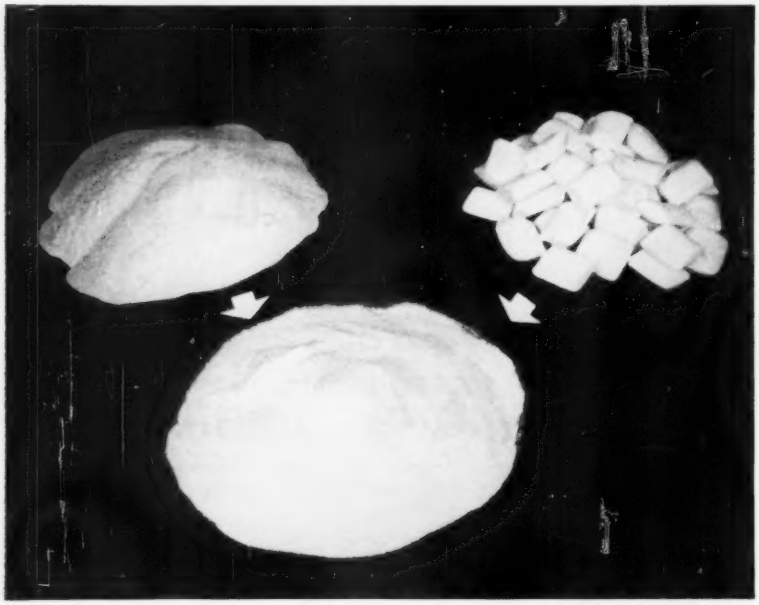
Errors Avoided—The active ingredients—sodium cyanide and copper cyanide—are present in the proportions required in the bath. This makes preparing or replenishing the plating bath a simple operation.

Chemical Handling Reduced—Sodium-copper cyanide double salt's balanced composition cuts down the handling of chemicals giving you an added safety measure.

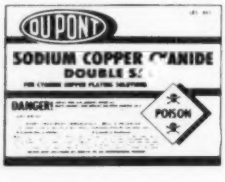
High Purity—Extremely pure basic constituents, careful manufacturing techniques, and low lead and sulfide contents give you a high-quality copper-plating product.

Double salt is prepared by crystallization from a filtered solution of Du Pont "Cyanobrik" sodium cyanide and copper cyanide. And new double salt contains no added materials such as sodium sulfocyanide.

Double salt is shipped in convenient, moisture-resistant 100-lb.-net fiber containers. For more information on this high-quality copper-plating salt, including information on price and delivery, call your Du Pont distributor or write today to your nearest Du Pont district or sales office.



• The same high quality that you have found in Du Pont Copper Cyanide (rear left) and "Cyanobrik" Sodium Cyanide (rear right) is combined into new, timesaving sodium-copper cyanide double salt (foreground).



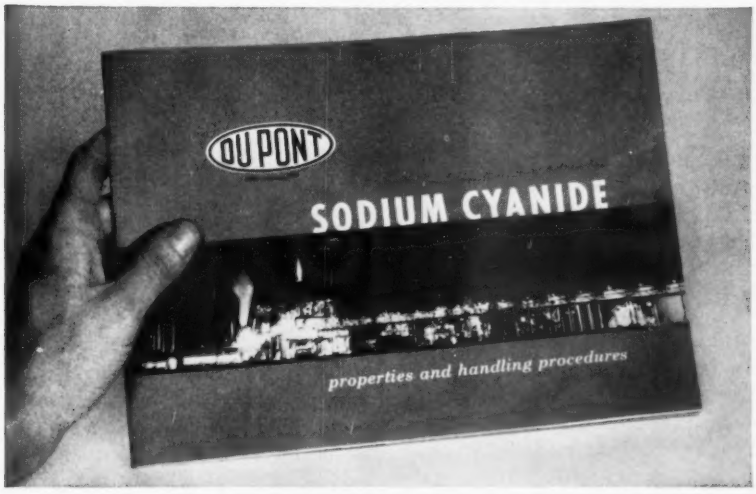
SPECIFICATIONS	
Copper	28.7% min.
"Free" sodium cyanide	0.4% to 2.0%
Lead	7 ppm. max.
Sulfides as sulfur	10 ppm. max.
Insolubles	0.01% max.

TYPICAL ANALYSIS	
Copper	29%
"Free" sodium cyanide	1%
Lead	Less than 1 ppm.
Sulfides as sulfur	Less than 5 ppm.
Insolubles	0.01%

DU PONT REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

FOR MODERN METAL PLATING



New Du Pont booklet gives you valuable information on uses, properties, and safe handling of sodium cyanide

Here's a valuable new reference book on Du Pont Sodium Cyanide. It describes safe handling procedures . . . uses . . . specifications and typical analyses . . . packaging, shipping and storage . . . waste disposal . . . and methods for analyzing sodium cyanide.

Be sure to get your copy of Du Pont's new sodium cyanide booklet. Just write to the Du Pont District Office nearest you.

A new high-speed cyanide copper-plating process

is available from Du Pont for plating steel parts and zinc die castings. Thoroughly field-tested, it's already being used for automobile bumpers and grilles, hardware products and wire. Advantages: low maintenance cost, only two addition agents needed, consistent and easily controlled performance. Contact your nearest Du Pont District Office for full information.

ELECTROCHEMICALS DEPARTMENT
Sodium Products Division

E. I. DU PONT DE NEMOURS & CO. (INC.)
Wilmington 98, Delaware

New Du Pont laboratory nearing completion

designed to help solve your metal-plating problems . . .

This spring the Du Pont Electrochemicals Department's *New* Sales Technical Laboratory will begin providing extra support for the services now offered by your Du Pont distributor and your Du Pont technical representative.

This new lab will be used for the development of new and better plating products and processes. It will contain the latest plating equipment necessary to study and solve problems encountered with both large and small units. In many cases, Du Pont will be able to duplicate actual customer operations. In addition, this installation will house conference rooms and a technical library.

No need to hold off, if you have a plating problem. Get in touch with your Du Pont representative or Du Pont distributor; he'll be glad to help you.

DISTRICT AND SALES OFFICES

BALTIMORE 2,
321 Fallsway
BOSTON 10,
140 Federal St.
CHARLOTTE 1,
427 W. Fourth St.
CHICAGO 30,
7250 N. Cicero Ave., Lincolnwood
CINCINNATI 2,
2412 Carew Tower
CLEVELAND 20,
11900 Shaker Blvd.
DETROIT 35,
13000 W. Seven Mile Rd.
KANSAS CITY 20,*
Guinotte & Mich. Aves.
LOS ANGELES
P. O. Box 70, El Monte, Calif.
NEW YORK 1,
350 Fifth Ave.
PHILADELPHIA
308 E. Lancaster Ave., Wynnewood
SAN FRANCISCO 4,
111 Sutter St.
*Barada & Page, Inc.
Export Div.
Du Pont Building, Wilmington 98, Del.

23/Circle on Readers' Service Card

DU PONT PRODUCT NEWS

REG. U.S. PAT. OFF.

Don't judge the cost of a cleaning process by solvent or chemical costs alone

Du Pont's new Cost Analysis Service can help you determine total costs . . . the only realistic basis of comparison

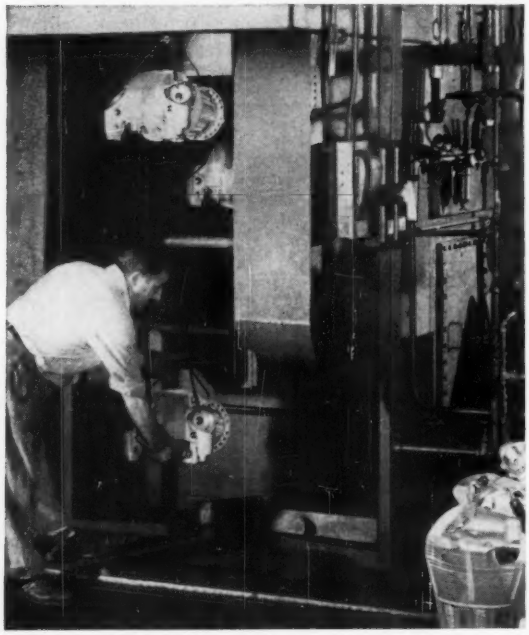
It's easy to draw misleading conclusions about the comparative costs of vapor degreasing and wet cleaning by comparing only the cost of trichlorethylene versus alkali chemicals. Such conclusions can result in a costly mistake when choosing a metal-cleaning process. *Invoices tell only part of the story!*

Du Pont has initiated this new cost-analysis service to help you find out what your metal cleaning is now costing, or, in the case of expansion or new installations, to help you determine the most efficient and economical process. Based upon sound accounting principles and 25 years of Du Pont "know-how" in metal cleaning, this service reveals the *total* cost of your operation. All cost factors are considered, including utilities, maintenance and depreciation, labor and the important item of "return on investment."

This Du Pont service can save you real money—in your present operation, or in the consideration of new or replacement equipment. Example: in a plant operating 7 degreasers, over-all cleaning costs appeared out of line. Changes adopted as the result of a Du Pont survey paid off in savings of $3,000 to $6,000 per degreaser.

GET ALL THE FACTS about this informative, cost-saving service. Just ask your local distributor of Triclene® D trichlorethylene, or send us the coupon at right, below.

* * *



• Conveyorized vapor-degreasing unit cleans oil, grease and chips from machined aircraft cylinders.

Why vapor degreasing with "TRICLENE"® D is ideal for assembly-line cleaning

It's fast —Vapor degreasing with "Triclene" D removes grease, oil, cutting compounds and other contaminants—usually in less than a minute!

It's thorough —Vapor degreasing with "Triclene" D leaves parts clean and dry—instantly ready for the next operation; never causes etching or staining—leaves no deposits of any kind.

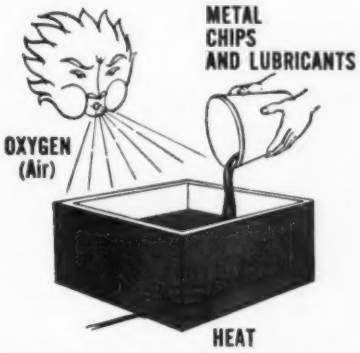
It's versatile —Vapor degreasing with "Triclene" D will clean parts made of all common metals and alloys, in any size or shape.

It's economical —Vapor-degreasing equipment is compact and inexpensive to install. Parts come out dry, eliminating need for dryers—saves valuable floor space. Superior cleaning action of "Triclene" D eliminates rejects, cuts downtime.

It's easy to operate —Anyone can do it. In fact, vapor degreasers can be run automatically. Du Pont will be glad to provide instructions for proper operation of your vapor degreasers if you wish.

▶ **If you would like to know more about degreasing, or want to be sure you're getting the most efficient cleaning from your present degreaser, call your Du Pont "Triclene" D distributor. If needed, he can call in one of Du Pont's metal-cleaning experts. You can also contact any Du Pont district sales office or use the coupon at right.**

FOR MODERN METAL CLEANING



Completely stabilized against breakdown

TRICLENE® D
Trichlorethylene

assures fewer degreaser cleanouts

You can count on brighter, cleaner work and easier, less frequent degreaser cleanouts when you use "Triclene" D.

"Triclene" D contains special stabilizers to protect the solvent against the major deteriorating influences present in modern metal-cleaning operations . . . fatty acids, sulfur-bearing lubricants, oxygen, heat and metal chlorides. These stabilizers, in turn, are backed by a neutral acid acceptor. All of these stabilizers are designed to remain in the solvent indefinitely through distillation after distillation.

The stabilizers in Du Pont "Triclene" D do not combine with fatty acids and other contaminants to form sludge. This is your assurance that your degreaser will maintain peak operating efficiency with fewer, easier cleanouts.

Try Du Pont "Triclene" D and find out for yourself how "full-time" stabilizers make the difference!

New $2 million Du Pont Laboratory will help solve your metal-cleaning problems

In April 1958, the facilities of Du Pont's new Sales Technical Laboratory will provide extra support for the services now offered by your local distributor of "Triclene" D and your Du Pont Technical Representative.

This modern laboratory will have the latest conveyorized production-line vapor-degreasing equipment, including an ultrasonic unit . . . all equipment needed to research problems encountered in both large and small units, hand-operated or mechanized.

Accurate metering devices will make it possible to pinpoint utility costs and to determine solvent losses for all types of production operations. Customers' actual plant conditions can be duplicated and evaluated against norms established at this new laboratory. Actual and theoretical operating costs can be compared.

Ask your Du Pont Technical Representative for further details about this new laboratory—the finest of its kind—soon to be ready to help *you!*

NEW LABORATORY contains 25,000 sq. ft. of floor space and will contain full-scale equipment for demonstration and customer service.

How's your supply of "Tri"?

Check your supply of trichlorethylene and be sure you won't be caught short during peak work loads. If you're low, better give your local distributor of "Triclene" D a call. He's well equipped to handle your orders promptly and efficiently.

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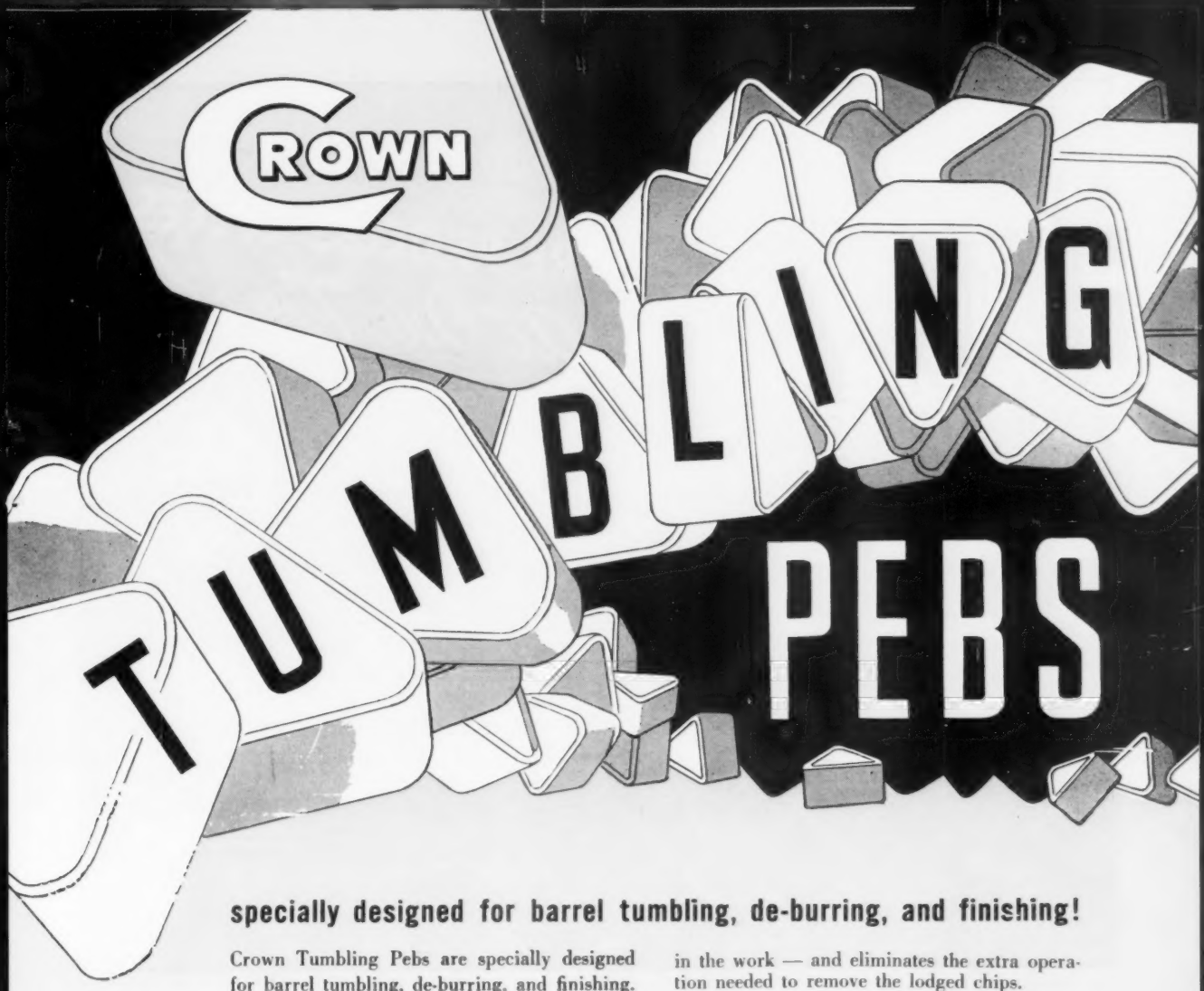

specially designed for barrel tumbling, de-burring, and finishing!

Crown Tumbling Pebs are specially designed for barrel tumbling, de-burring, and finishing. They are manufactured of a tough, white ceramic, uniform in size and shape, and available in a variety of sizes. Crown Pebs have many advantages in tumbling operations and are widely used for de-burring and similar tumbling processes in many types of barrel tumbling equipment.

Eliminates lodging in holes . . . Crown Pebs eliminate the "lodgement" hazard of random shaped chips. Just select the proper size, and the uniform size and shape of the Crown Pebs eliminates lodging in holes, recesses, and slots in the work — and eliminates the extra operation needed to remove the lodged chips.

Longer life . . . The tough wear resistant ceramics in Crown Pebs give a service life several times longer than either natural stones or the aluminum oxide type of tumbling chips.

Crown Tumbling Pebs do not cut as rapidly as random shaped natural stones and aluminum oxide chips, but the uniform results and their much longer life make them very valuable in many tumbling and de-burring operations.

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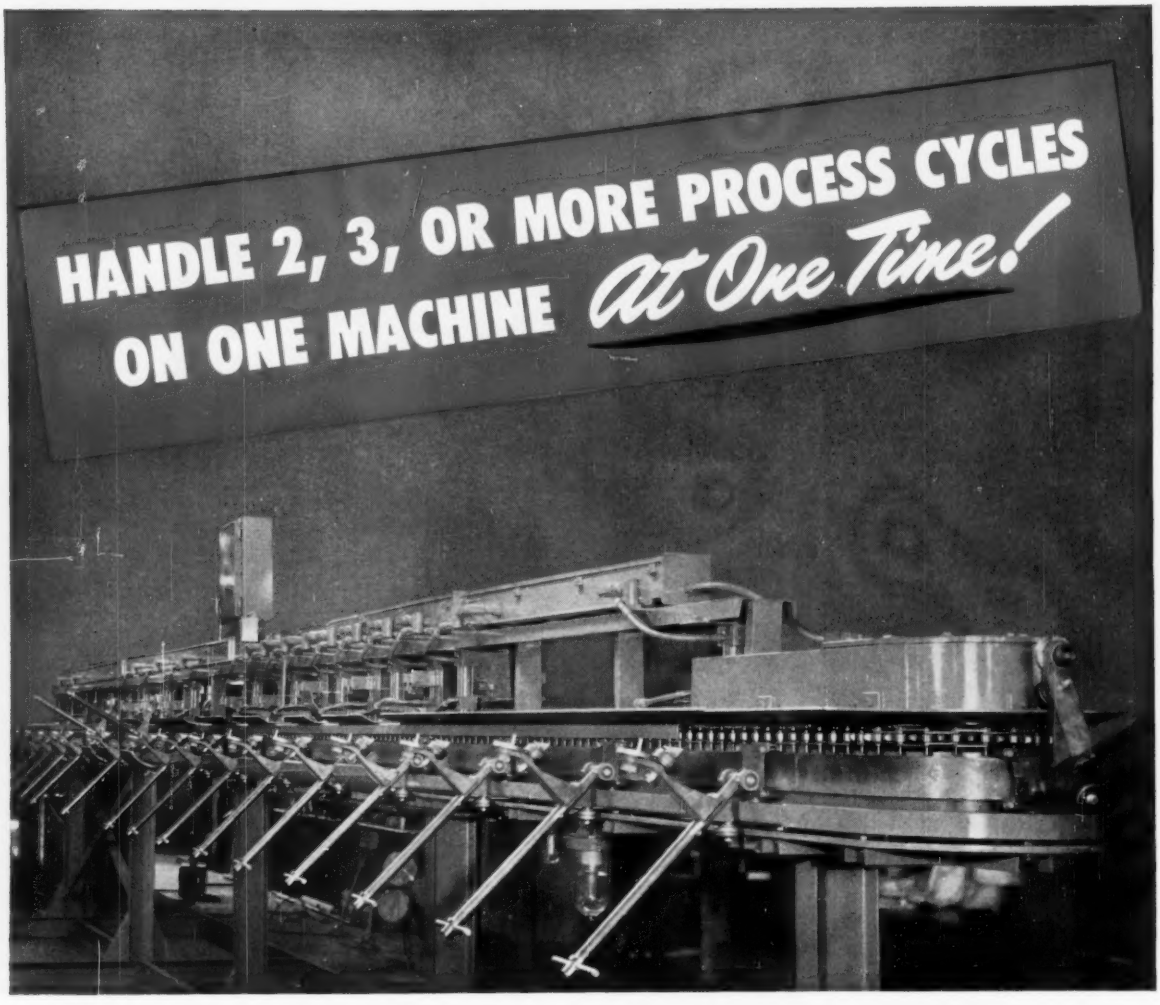

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The Select-O-Matic is easily adaptable to any operation. Tell Lasalco about *your* operation and requirements to learn what this new machine can do for *your* production and profits.

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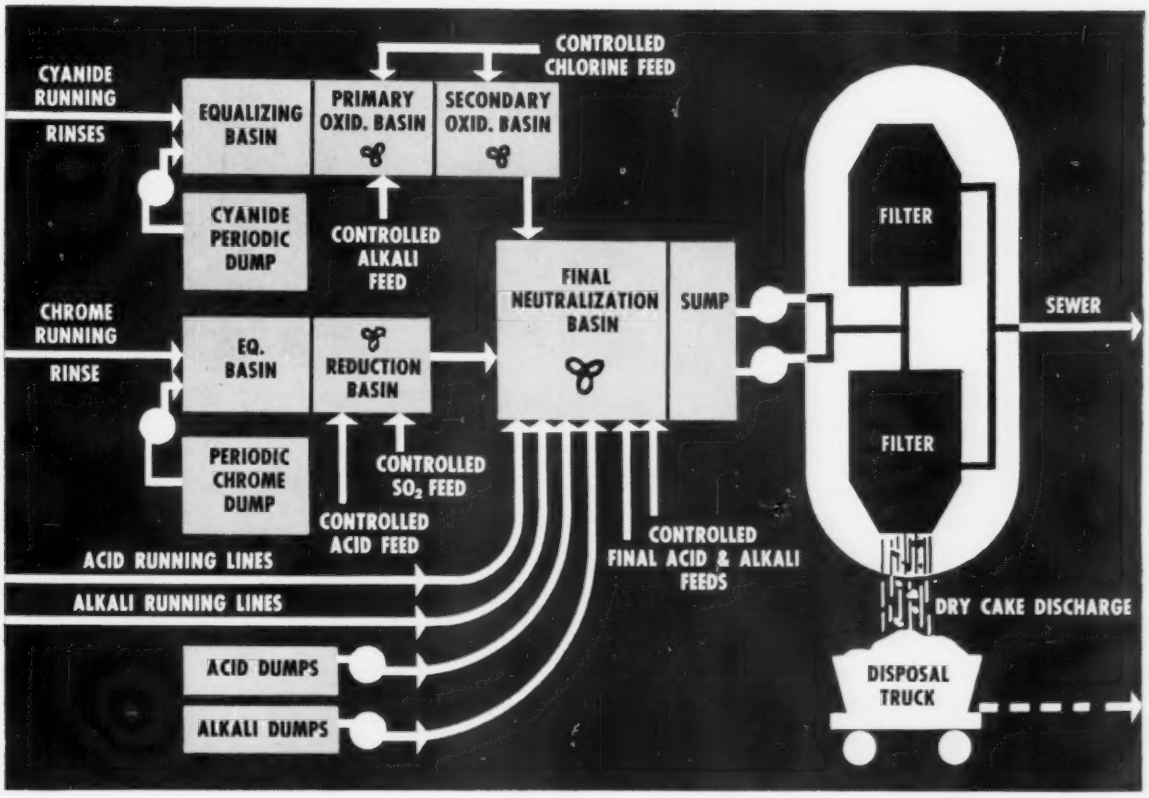

How to get rid of plating wastes without the cost or upkeep of conventional clarifiers

A large midwest appliance plant has several plating lines and wanted a centralized method for disposal of corrosive wastes. **When the bids were in, they chose this Industrial system** that uses compact modern filters instead of conventional clarifiers.

The plating lines discharge acid, alkali, cyanide and chrome wastes from rinsing operations and periodic dumps. Toxic chemicals are destroyed and then brought, together with other rinses, to a central basin where they neutralize one another, requiring only small amounts of added chemicals to precipitate the dissolved metals and permit their separation by filtration. The filters extract the solids and discharge a neutral non-toxic effluent to the city sewage system.

The tremendous advantages of this advanced system over conventional clarification and lagooning systems are pointed up in a simple check list:

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This is typical Industrial engineering . . . modern equipment skillfully designed into a time and cost saving system. On **your next plating problem—call Industrial** . . . you'll find our engineers the most experienced in the industry at handling plating fluids, from water purification to waste disposal.

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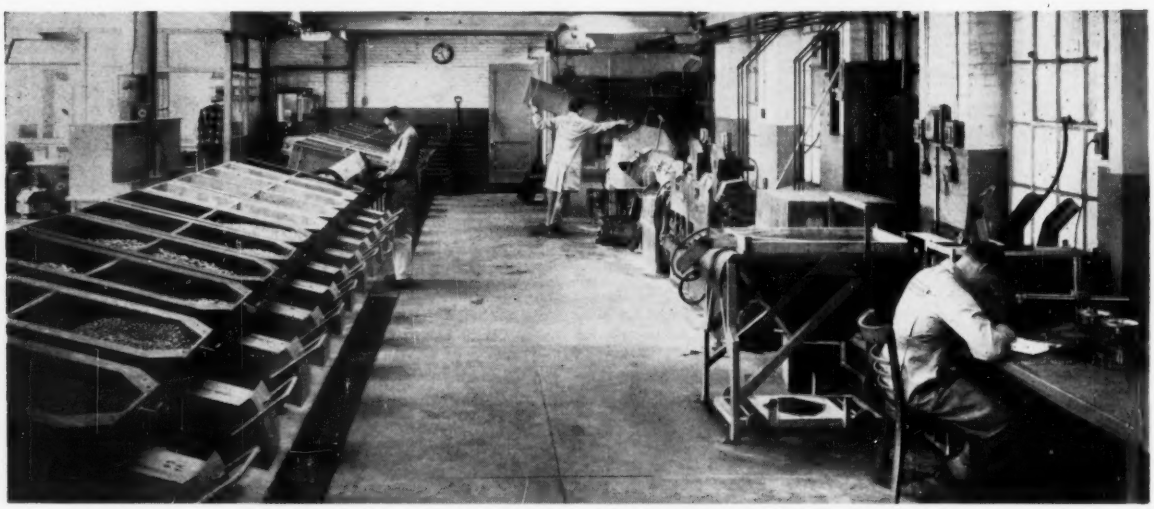

The big Norton Sample Processing Department solves your finishing problems with a wide variety of tumbling equipment . . . and the right abrasive to do the job.

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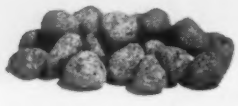

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If you're still finishing metal parts the long, hard way, now's the ideal time to find the fastest, most effective barrel finishing equipment, methods and abrasives.

For example, one leading aircraft parts manufacturer reports saving over $90,000 yearly by shifting from hand-finishing to barrel finishing with Norton TUMBLEX abrasives.

There's one sure way for you, too, to get these cost-cutting, product-improving "Touch of Gold" advantages. Your metal parts can range from tiny needles to hefty forgings . . . may be simple or complicated, hard metals or soft . . . may require deburring, descaling, better color and closer finish. Just send sample parts to our Sample Processing Department. They'll be returned to you completely finished to requirements, with a detailed report. Or, next time you're in our area, drop in and learn how your finishing can be improved.

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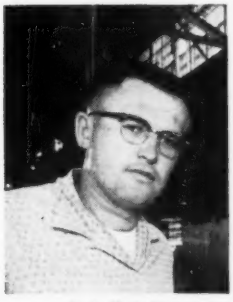
...and it's completely automatic!" says R. J. Munsey



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Reliance Division
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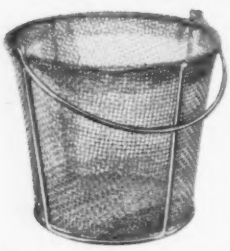
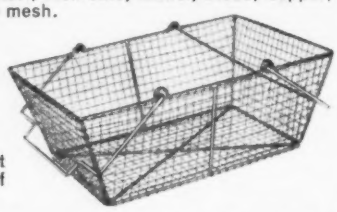


New Dipping Baskets—tapered to nest and last longer. A dozen nests in a stack only 36″ high. Store in small space. Easy to move. Nesting keeps the floor clear—no traffic obstruction—easy to clean. Prevents damage to baskets from traffic or rough handling when not in use.

The basket illustrated is ¼″ mesh, size No. 11; height, 11″; I.D., 12″ at the top, 10″ at the bottom. Available in plain steel, plastisol coated steel, stainless steel, nichrome, monel, brass, copper, iron, aluminum. Any size mesh.

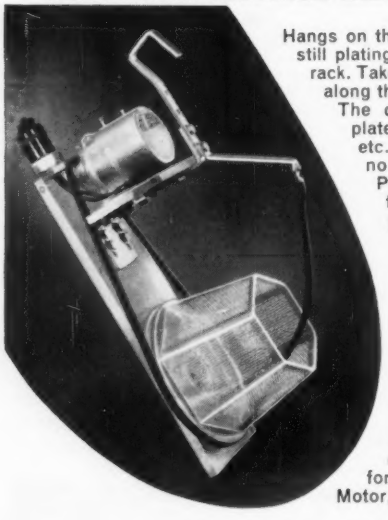
Tote Basket NESTS too!



O.D. at top, 13½ x 20; at bottom, 10 x 16. Mesh of basket shown, ⅝″.

Wonderful for handling plating work. Water drains off, parts stay bright and clear instead of rusting. Makes handy container for shipping or delivery. Nesting saves handling time and helps protect the baskets when moved empty.

BELKE Rack-Mounted Barrel Plater



Hangs on the cathode rod in a still plating tank like a plating rack. Takes only 6 to 7″ space along the cathode rod.

The quick easy way to plate small lots, samples, etc. with no delay; and no production tie-up. Plates any quantity from a spoonful to a pint in practically any plating solution.

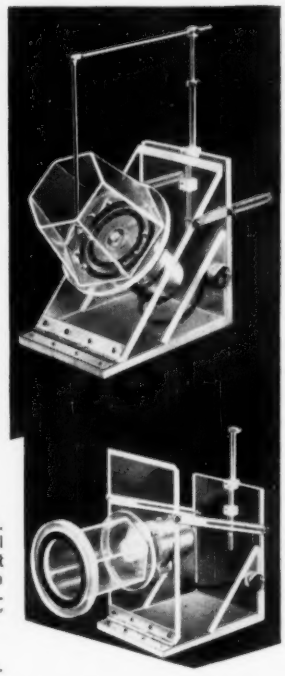
No cover. Just lift out of the tank and pour the work out; reload and hang on the cathode rod.

Cylinder inside dimensions: 4⅛″ deep, 4⅛″ at small end, 5¾″ at large end. Standard perforations, 1/32″.

Motor, 115V, 60C, 1 phase.

BELKE Laboratory Model

Polishes—Burnishes Plates Requires no tank



Holds the smallest parts, perfectly. Plates from a spoonful to a pint, most any solution.

Easy to empty. No latch, no cover. Cylinder lifts right off to pour out contents.

Easily removed button contacts; permit changeover from gold to zinc, copper, etc. in seconds.

Marvelous for small jobs; sample runs; small, pointed parts that go through or lodge in cylinder perforations.

Cylinder I.D.: 5″ deep; 4″ at small end; 5½″ at large end.

Burnishes too!

Drive support panel is hinged. To burnish, adjust to vertical position as shown at right; lift off plating cylinder and set on burnishing cylinder. Burnishing cylinder I.D.; 5″ long; 4″ diameter.

Motor is 115V, 60 cy., 1 phase.

BELKE Super Scooper

Recovers non-magnetic parts, too!

Scoops up parts lost in the plating tank—including brass, die castings and other non-magnetic parts that even the popular BELKE Tank Magnet will not get. Works easy and fast; enables you to get the parts out before they contaminate the bath. Steel handle is 52″ long with lever that operates cover from above solution. Scoop is 8½″ wide, 7″ long, and 4½″ high.

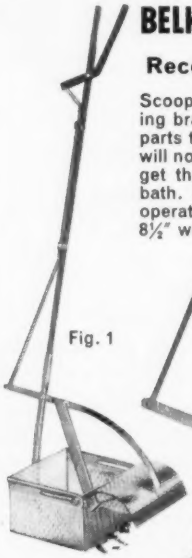


Fig. 1

Scoop with cover open collects parts on the bottom of the tank.

Easy to use

Just hold cover up and gather the parts by sliding scoop along the tank bottom. (Fig. 1) Then drop the cover which comes down ahead of the parts (Fig. 2.) Now close the cover which pushes the parts into the scoop.

Fig. 2

Note how cover comes down ahead of the parts. Closing pulls cover along bottom and pushes parts into scoop.

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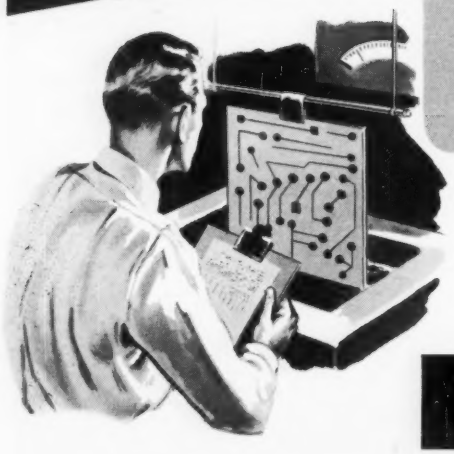

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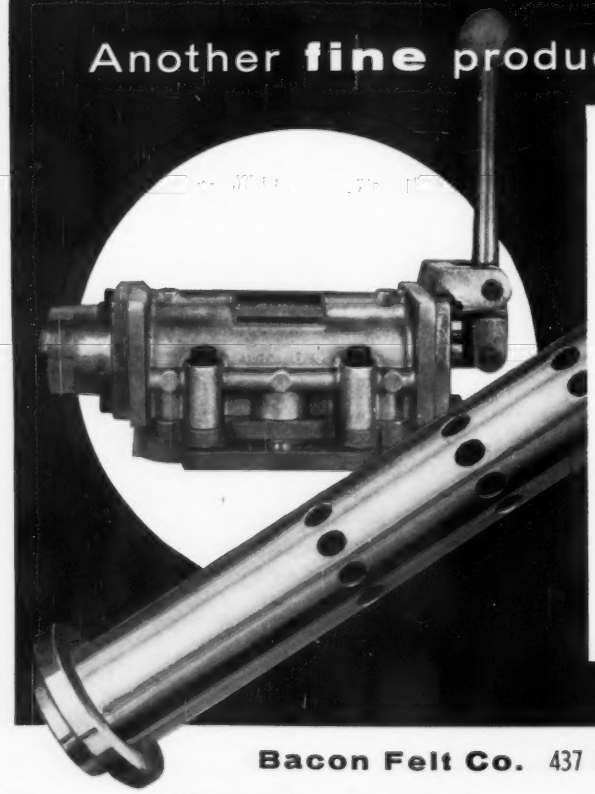

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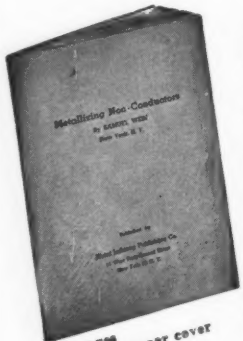
BOOKS FOR THE PLATER

Metallizing Non-Conductors

By SAMUEL WEIN



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The present work deals with every known method for "metallizing" or the deposition of metals by electrolysis (plating) or non-conductors. It is divided into several sections, i.e., those processes which use chemical, mechanical and physical methods for treatment of surfaces for metallizing. In these groups the specific methods are chronologically reviewed and so the reader can very readily get a better idea of the progress made by the various workers in these arts. At the end is an alphabetical listing of contributors to the art, so that the serious workers can refer to the original sources of the information given in the text by Mr. Wein.

The text is prepared in a practical fashion so that the formulas given will be of material use and is the result of literature collected by the author for more than 25 years and which has been in use by a number of industrial concerns here in the United States and abroad.

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We use Lacquer Thinner on:
☐ Metal ☐ Wood ☐ Other
We want it to dry: ☐ Fast ☐ Slow ☐ Medium
COMPANY NAME_____
NAME_____
Address_____
City_____ Zone_____ State_____
PLEASE COMPLETE COUPON—IT HELPS US TO HELP YOU.

POTTER Paint Co.
or **Cortland 3, New York**
Cambridge City 3, Indiana
Write to your nearest location

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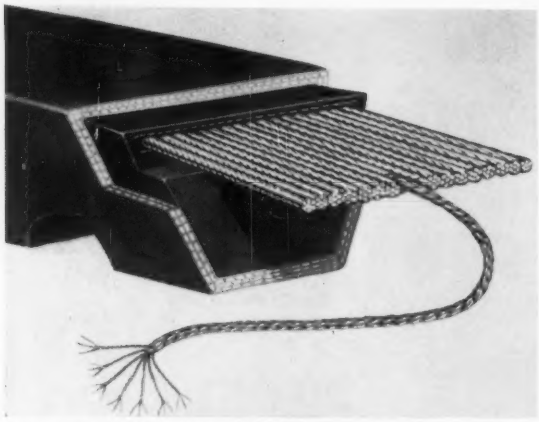
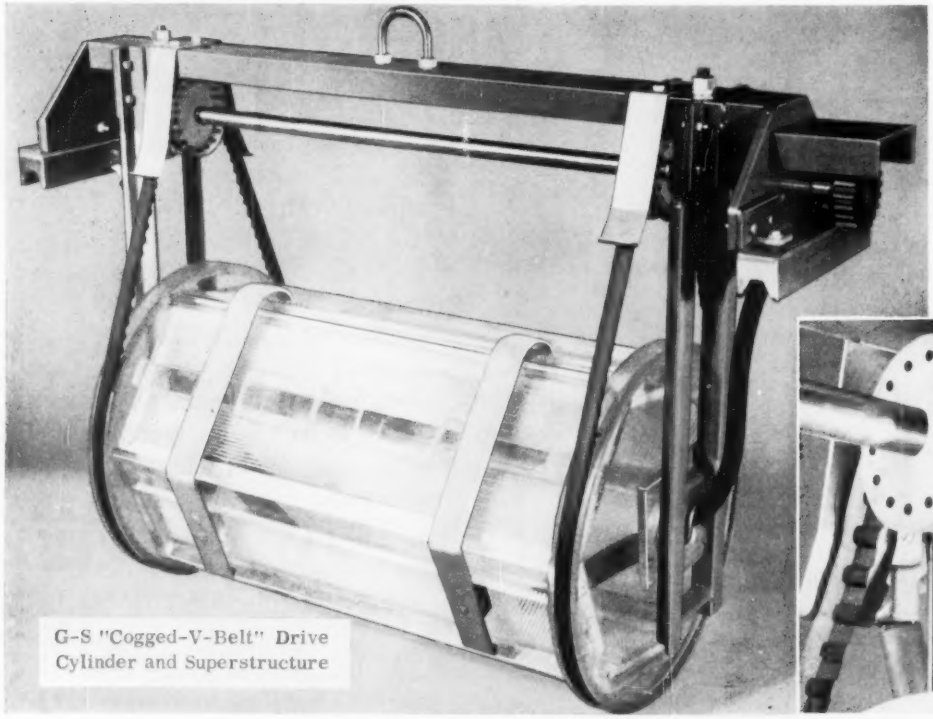


more reasons why . . .

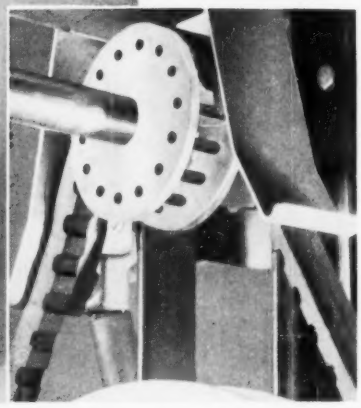
G-S means Greater Savings

"Super" Cogged-V-Belt: Strongest, most efficient, longest wearing ever perfected for plating barrels, available only from G-S. Not to be confused with belts on other makes. Developed by leading V-belt manufacturer and G-S engineers. Unique cogging principle; done on special, G-S designed machinery. Test-proven to outperform, out-last any in the field. Oil-chemical resistant Neoprene body; heavy-duty, non-stretch Stainless Steel tensile members, and double Nylon envelope for trouble-free, extra-long service. Shorter, huskier belt "teeth" add grip-strength, wear resistance. No slippage possible. Another G-S "Exclusive" for better, faster, lower cost barrel plating.



G-S "Cogged-V-Belt" Drive Cylinder and Superstructure

G-S "Cogged V-Belt" Drive



"The Belt-Drive with the Gear-Grip" Saves 100% Gear Maintenance.

Eliminates: cylinder-end drive gear, idler gear, pinion gear, 3 bearings. No gears or bearings in solution.

G-S Gives You More Exclusive Features

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★ **Floating End Plates** for constant contact of inverted V-blocks. Can't rock in saddles. More contact.

★ **Longer Inverted-V-Contacts** offer 16" more contact area, up to 30% greater current flow per load.

★ **Automatic Positioning** — Guide channel directs superstructure into operating position, quicker, easier.

★ **Adjustable Bearings** support drive shaft — maintain constant-mesh with motor drives at all times.

★ **Floating Hubs** with danglers angled downward for constant cathodic contact in center of load. Won't "ride" up on top of load.

★ **Heavier Dangler Cables** for higher current carrying capacity, longer life, better operation.

★ **Faster Dangler Cleaning** — Slide out hub-lock: 10 secs. Interchange cyls: 5 mins. Cuts hours off usual time.

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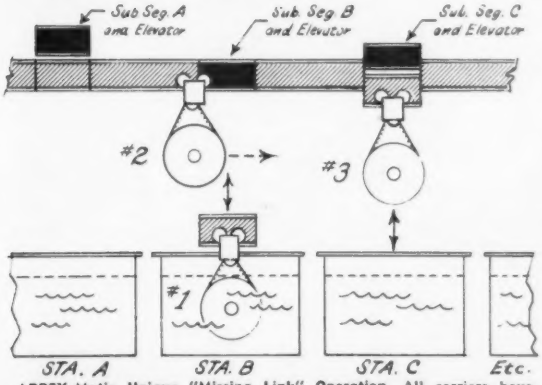
Here's efficiency you can't afford to overlook! Keep your own operations in mind while you trace the high-production flow of this ABBEY-Matic layout for a manufacturer of electrical wiring devices.

One man: 15,000 lbs. of barrel plating per day with ABBEY-Matic. Hourly production rate is twelve 200-lb. barrel-loads for zinc plating with bright dipping, and one for brass plating. 5 minutes allowed for 1 operator to work set-up. He loads at #13, feeding barrels into accumulate area #14. He also unloads at #12, dumping each barrel-load into 2 baskets for quick-dipping by monorail into #15 thru #19, and centrifugal dryers #20a and #20b.

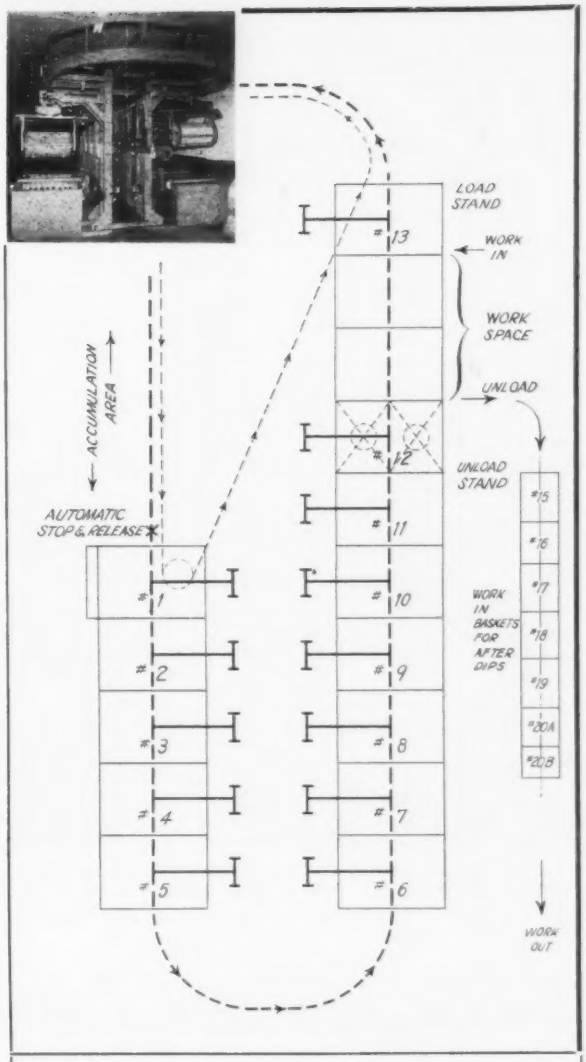
ABBEY-Matic does the processing without manual operations. Barrels feed through accumulate area #14 to automatic stop and release "X", from where each barrel is released into processing at 5-minute intervals. They proceed through complete cycle from #1 thru #12 — *all automatic.* Finishing a day's run, the operator unloads all processed barrels from the machine until empty, while continuing to load as usual so that about 6 loaded barrels are ready to be released next morning without lost processing time.

Found: The "Missing Link" to Flexible, Multi-Cycle Selection. Carriers function as robots, independent of each other, automatically "leap-frogging" occupied stations, "by-passing" wrong stations, "entering" right stations — by remote control. This is an exclusive feature of ABBEY-Matic's principle (Pats. Pending) of "missing link" substitute track segments replacing main track segments which are lowered by individual station elevators with carriers to process tanks (see diag.). Free-way is thus maintained on main track regardless of carriers in process stations. In multiple cell high production set-ups, carriers are permitted to enter only one cell of an identical process station, and will automatically by-pass the others in any order.

ABBEY-Matic Cuts Costs — does the job with less equipment; eliminates skilled manhours. Movements and timing are predetermined, and actuated by simple, fail-proof electro-mechanical devices. Carriers can be selected and transferred at random for any station. Processing time for different loads is allotted individually, can be varied station-to-station by separate timer controls. Only ABBEY-Matic *non-synchronized* carrier and station impulse-memory signaling and control make *full automation* possible. Learn how ABBEY-Matic can bring *full automation to your plant.* Ask about ABBEY-Matic Medium-Duty Rack Machine.



ABBEY-Matic Unique "Missing Link" Operation. All carriers have by-passed Sta. A. Main track segment in place. Carrier #1 was lowered by Sta. B elevator on main track segment into process, while substitute segment in main track allows carrier #2 to "leap-frog" carrier #1. Sta. C elevator and track segment are lowering carrier #3 into process, allowing substitute segment to fill gap in main track.



BBL PLATING AUTOMATION CYCLE

Station	*Cycle*
1	Electro-Clean
2	Warm Rinse
3	Acid Dip
4	Cold Rinse
5	Cyanide Dip
6	Zinc Plate
7	Zinc Plate
8	Zinc Plate
9	Brass Plate
10	Rinse
11	Rinse and Spray
12	Unload

BBL PLATING AUTOMATION CYCLE

Station	*Cycle*
—	Space
—	Space
13	Load
14	Accumulation and Feed

POST TREATMENT CYCLE

Tank No.	*Description*
15	Chromate Brite Dip
16	Rinse
17	Bleach
18	Cold Rinse
19	Hot Rinse
20a & b	2 Centrifugal Dryers

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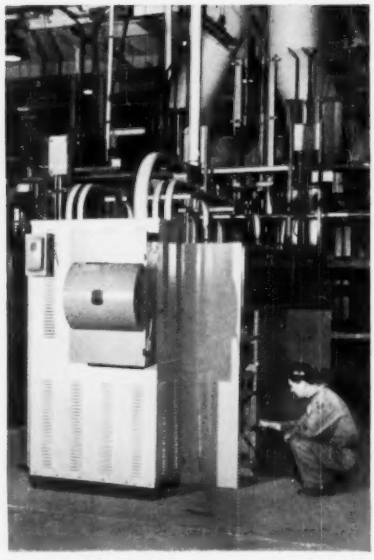
Art Pfeifer (left), Assistant to Rheem's Division Manager, discusses G-E germanium rectifier installation with J. A. Raskin (examining report), Vice President, and Norman Dieball, Electrical Engineer. Mr. Raskin and Mr. Dieball are of the L. H. Butcher Co., west coast subsidiary of Udylite Corp., which installed the automatic bumper plating line.

"General Electric Germanium Rectifiers.....

R. D. Scott, Udylite Corporation Chief Electrical Engineer, who assisted in planning, discusses Rheem's electrical system.

Rheem Automotive's new plant in Fullerton, Cal., has been in operation over a year plating bumpers, other auto parts.



Two 15,000-amp and two 20,000-amp rectifier cubicles, each 15 volts, feature compact construction, floor-mounting.

Light weight and "building block" flexibility of G-E automatic germanium plating rectifiers allow installation on overhead platforms, saving floor space. Inductrol* voltage regulators (left) allow efficient, economical, stepless, and automatic control, are integral part of system.

....tops in automatic plating performance..."

says Art Pfeifer, Rheem Automotive Co., Fullerton, Cal., after year's successful operation

General Electric automatic germanium rectifiers are giving top performance after more than a year's continuous operation;—providing reliable, efficient DC power. So reports Art Pfeifer, Administrative Assistant to the Division Manager of Rheem Automotive Company's new Fullerton, California plant.

The largest installation of germanium rectifiers in the plating industry, this equipment produces 160,000 amperes of direct current at 15 and 18 volts. Each germanium unit is equipped with Inductrol automatic regulating control, making possible automatic voltage or current stabilization. Eighteen units (each rated 5,000 amperes at 18 volts) are mounted overhead to power nickel-plating tanks. Two 15,000-ampere and two 20,000-ampere units, each rated at 15 volts, are floor-mounted.

General Electric germanium rectifiers are lightweight, compact, and allow a "building block" arrangement designed for maximum installation flexibility and ease of maintenance. Floor space for each 5,000-amp unit is 17 square feet—less than 50 percent of a comparable motor-generator. Each unit weighs 5,000 pounds—approximately 40 percent of a comparable motor-generator. Each rectifier cubicle has General Electric's famous hermetically sealed rectifier cell for protection against corrosive atmospheres. All these advantages can be realized at a sizable initial cost saving over motor-generator sets.

The Rheem installation is one of General Electric's many germanium rectifier installations now totaling more than 75,000 kw.

Let your plating agent show you how you, too, can benefit from the economy and efficiency of G-E plating rectifiers. General Electric Co., Schenectady 5, N. Y.

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- Sold as a Concentrate
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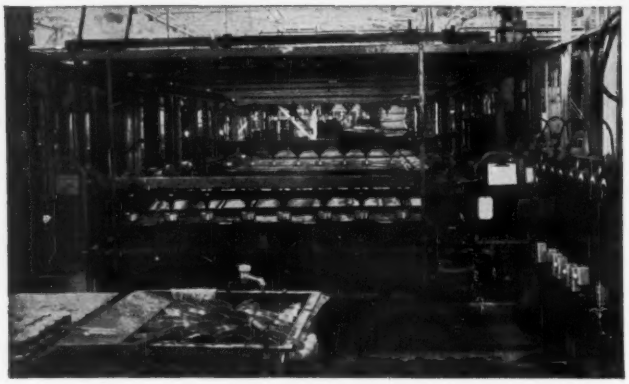
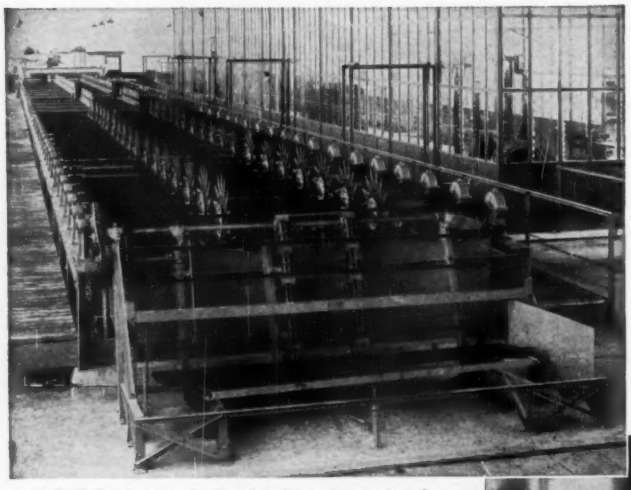


U.S. Fully Automatic Equipment for processing and heavy copper plating the bottoms of popular brand stainless steel cooking utensils. 10 such U.S. installations are in service in 3 plants of this manufacturer.



U.S. Fully Automatic Conduit Pipe Processing Installation. Performs 24 operations in one continuous cycle including cleaning, acid treatment, zinc plating pipe exterior, enamelling and baking interior surface. Capacity—over 60 million feet of pipe per year. Glass enclosure houses U.S. Generator Equipment.

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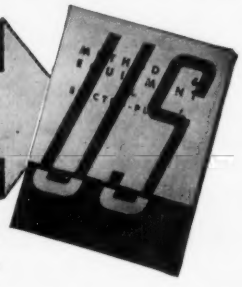

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APRIL, 1958 Volume 56 Number 4

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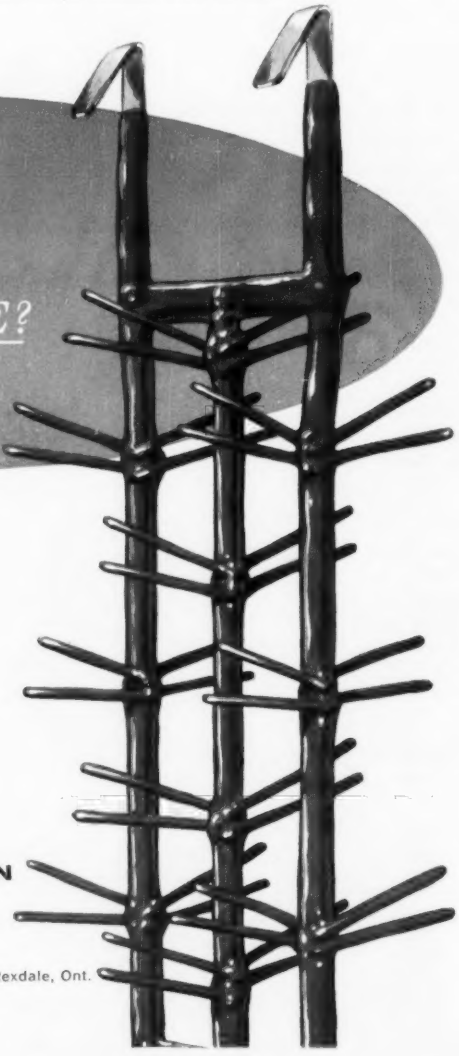

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Finishing Zinc Alloys

Every plater who has had occasion to process zinc-base slush or die-castings is familiar with the special problems which this material presents. Unless casting and polishing procedures are carefully chosen and controlled, the dense, fine-grained skin may be removed, exposing an unsound base for subsequent plating. Undue delay between buffing and cleaning, especially in warm, humid environments, may result in a reaction between the metal and fat in the buffing compound film, to form insoluble zinc soaps. Zinc alloys are also readily attacked by many cleaners, acid dips, and plating solutions, so that lowering of one's guard is soon reflected in poor finish, solution contamination, and blistering, especially the last.

Yet, despite these unfavorable characteristics, zinc-base die-castings are being processed successfully on a vast scale although, under the circumstances, it is to be expected that rejects will be somewhat greater than when applying the same processes to brass or iron. This success has been due to close attention to detail and to the availability of very effective casting, polishing and plating methods, developed mostly by trial and error over the years. Modern industry is not satisfied with trial and error methods, however, and it is gratifying to see the reports of studies emanating from research laboratories concerning the two major defects, pitting corrosion and processing and service blisters.

Microscopic examination of service blisters have indicated them to be a manifestation of pit corrosion, since the blisters are generally filled with white corrosion products. It is clear, therefore, that the performance of a plated die-casting in service is determined primarily by absence of porosity in the deposit. Although increasing the thickness of copper and nickel deposits is the obvious and proven method of decreasing porosity and increasing the resistance to penetration of the coating by atmospheric corrodants, we do not believe that sufficient emphasis is being placed, in many plants, on the connection between dirt in the processing solutions and porosity in the deposit. It is customary to keep the plating baths filtered, mainly to avoid roughness, but how many plants filter their cleaners, acid dips, and rinse waters?

Process blisters, which occur during or immediately after plating, are the plater's real headache, coming and going even without any change in the cycle. They are believed to be due to casting defects or to surface irregularities produced during polishing and plating and, although numerous suggestions have been made for their elimination, including the use of milder cleaners and acid dips, and dry storage of raw castings to avoid surface corrosion prior to polishing, a foolproof system has not yet been disclosed. However, studies of blistering have brought to light one observation which should put to rest for all time a commonly-held belief; none of the blisters examined have been found attributable to diffusion between the copper deposit and the underlying zinc!

Nathaniel Hall

Factors Affecting Residual Stress In Electrodeposited Metals*

A Critical Evaluation

By Joseph B. Kushner, Ph.D., *Director, Electroplating School, Stroudsburg, Pa.*

Introduction

THE practical and commercial importance of residual stress in electrodeposited metals has been pointed out by several reviewers in the past.[1-3] Such stresses may cause peeling, tearing, and blistering of the deposits;[4-8] they may cause serious distortion of light gauge basis metals and electroformed parts;[9] they may accelerate corrosion and corrosion cracking;[10-14] finally, they may seriously shorten (in the case of tensile stresses) the fatigue life of steel and other basis metals.[15-20]

From the theoretical side, the subject of residual stress is likewise important. Residual stress is a manifestation of defect in crystal structure and, just as the research physiologist learns much about the normal structure of the cell from the abnormal cell, it may be possible to learn much about the structure of electrodeposited metal from its stress behaviour.

Despite these weighty incentives, research in the field of residual stress has been rather limited. In going over the early work, one finds a bewildering array of findings based on various deposit thicknesses, different acidities, concentrations, and current densities. There seems to be a welter of conflicting results, and the origin of residual stress is still almost as obscure as it was a century ago when Gore[21] first described it as a state of "unequal cohesive tension."

The purpose of this study was to obtain, if possible, more definite relationships between residual stress and causative factors, as determined under a standard set of operating conditions, and to examine these results and those of other workers in the field, critically and analytically, in an attempt to bring some of the aspects of the subject into sharper focus.

Some Important Theories

There has been no lack of theories explaining the cause of residual stress in electrodeposits. Except for the recent past, there has been much speculation and little experimentation. Unfortunately, the theories, by and large, do not explain all of the known experimental facts; the raison de être is still hidden in the mists of ignorance. Nevertheless, it is of interest to examine some of the most important of these theories for whatever light they may shed on the problem.

HYDROGEN AND HYDRIDE THEORIES:

A number of theories have it that hydrogen is taken into the lattice during deposition, either in ele-

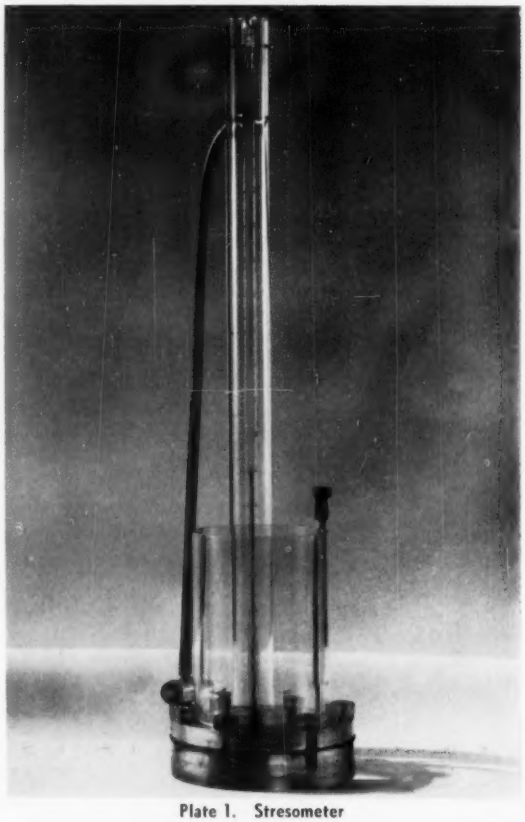


Plate 1. Stresometer

*Condensed from a dissertation presented to the Graduate Faculty of Lehigh University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

mental atomic form or as a metallic hydride,[22,23] which causes a temporary expansion of the lattice. Later, as hydrogen diffuses out or the hydride decomposes, shrinkage occurs and a contractile stress results. The theory is attractive, since most of the transition metals are deposited at less than 100% cathode efficiency, and these are the metals that show high residual stress. There is also some direct experimental evidence in the work of Kohlschutter,[24] and Vuilleumier[25] who found that, if hydrogen is plated out on a nickel deposit in residual tensile stress, the stress diminishes almost at once to a low value and then climbs up again when the current is shut off. Even as late as 1955, Evans[26] indicates that he still finds the hydrogen theory the least difficult to accept.

Excess Energy Theories

Glasstone,[27] and Graham and Soderberg[6] propose that, at the moment of deposition, the metal atoms or ions are in a high energy state due to the metal overvoltage (activation overpotential). For this reason, the lattice is temporarily expanded and there is a subsequent contraction, which leads to the formation of contractile stresses in the deposit. Evidence for the theory can be found in the work of Barklie and Davies[28] who noted that stress in electrodeposited nickel shows a linear variation with the deposition potential. It is also substantiated by the results of Vagramyan and Tsareva[29] who find that metal overvoltages increase in the following order: zinc, copper, nickel, chromium, palladium, and that the internal stress in these metals likewise increases in the same order. Additional evidence can be found in the work of Stager[30] and Marchese.[31]

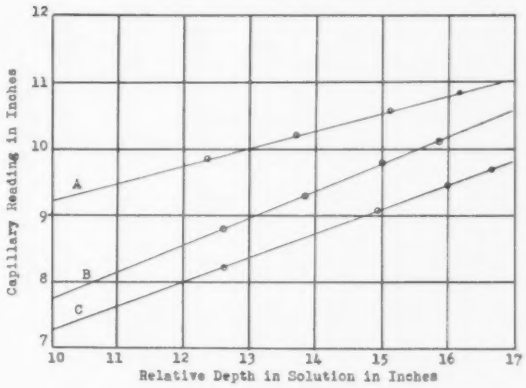
Recently, Murbach[32] and Murbach and Wilman[33] and Wilman[34] have proposed a variation of the excess energy theory. On the basis of stress measurements made on evaporated metal films, stress measurements in electrodeposited films and electron diffraction evidence, they suggest that the immediate surface region of a growing cathodic deposit, say a layer no thicker than 10 Å or so, reaches a temperature of several hundred degrees Centigrade. On each side of this layer there is a very steep temperature gradient, in the cathode on one side and the electrolyte on the other. Thus, the electrodeposited metal lattice is actually put down at a considerably higher temperature than the surroundings and, on subsequent cooling to the ambient temperature, tensile stresses are developed.

Occluded Matter Theories

J. B. O'Sullivan[35] ascribed the cause of residual stress to hydrate formation, and this theory was promulgated by Martin[36] who points out that organic acids, magnesium sulfate, and sodium sulfate, for example, which suppress hydrate formation when in nickel plating baths, also act to reduce tensile stress in the nickel deposits. Brenner[37] likewise suggests that the stress in nickel deposits arises from the presence of codeposited or adsorbed matter. In fact, he finds that, in the specific nickel plating solutions he worked with, an increase in stress is accompanied by an increased content of hydrogen and oxygen in the deposit. In a series of forty-six experiments he found the average ratio between the oxygen and hydrogen

FIGURE 1

STRESOMETER DISC CALIBRATION CURVES



A. Copper disc, .0420" thick.

B. Nickel disc, .0251" thick.

C. Stainless Steel disc (304), .0262" thick.

content of the deposits to be 8 ± 2.6 to 1. This would imply that hydrogen and oxygen are present in the deposits in the same ratio as they are in water. He explains this in either of two ways: 1) The codeposited matter in the deposits is of the type $MO_m \cdot nH_2O$ where n is much greater than m. 2) Oxygen and hydrogen exist in the deposit in the form of hydroxyl groups but there is sufficient free hydrogen present to reduce the ratio to 8:1. While it seems plausible that residual stress may be connected with the presence of foreign matter in the deposit, none of these investigators suggests a clear cut mechanism by which this foreign matter can produce the observed stresses, both tensile and compressive.

This is the current status of the most important theories in connection with the formation of stressed electrodeposits. It is obvious that there is much confusion and doubt.

Experimental Techniques

The metal used in most of the following experiments was nickel inasmuch as it is an easy metal to deposit, is subject to large variations in stress, and much is already known of its physical properties.[37] Since impurities have a marked influence on residual stress, all solutions used for test purposes were made up of reagent grade chemicals dissolved in distilled water, unless otherwise noted. The solutions were made up in four liter quantities and were purified by peroxide treatment at high pH, activated carbon filtration and dummying with corrugated cathodes.

The instrument used for measuring residual stress was the Stresometer. (Plate I), invented by the author. The story of this instrument has been covered in previous papers[38,39] and will not be discussed here.

The formula used in calculating the stress developed in the deposit is:

$$(1) \qquad S_a = \frac{A^2 (L - L_o)}{4Ktd}$$

where S_a is the average stress in the deposit in psi,

A is the radius of the metal disc (plated surface), L is the capillary reading at the time the stress is determined and L_o is the initial capillary reading, K is the disc constant, d is the thickness of the disc and t is the thickness of the deposited metal.

K, the disc constant, is obtained by determining the change in capillary reading when the disc is subjected to a known change in pressure. Typical calibration curves are shown in Fig. 1.

The experimental set up used for the experiments is illustrated in the photograph, Plate II.

It was recognized from the start that the nature of the surface and the surface treatment could be the cause of discrepancies so, unless otherwise noted, the following standard preparation method was used in all cases: 1) The disc used was soak cleaned in hot alkaline cleaner (6 oz./gal. trisodium phosphate), rinsed, then swabbed with a slurry of fine aluminum oxide and rinsed again. 2) The disc was electropolished for 3 minutes in a 50% by volume phosphoric acid solution at 180 amp./sq. ft. 3) The disc was vigorously flushed in tap water then rinsed in distilled water. Where weighings were made to determine cathode current efficiency, the discs were dried by dipping in acetone and holding in warm air. 4) On mounting the disc in the instrument just prior to use, the disc was lightly swabbed with a slurry of levigated alumina to remove any possible surface contamination, then rinsed in distilled water, and placed in the tempering bath which consisted of faintly acidulated distilled water (acidified with either sulfuric or sulfamic acid to prevent the formation of oxide films on the copper while the instrument reached bath temperature). 5) When ready for a determination, the disc was calibrated in this distilled water and then placed into the plating bath and the current switched on.

The pH used for the tests, unless otherwise noted was 4.0 $\pm$ 0.2. This pH region was used because it is known that both low and high pH ranges have a marked effect on residual stress. In the region of 4, stress values are usually at a minimum and show little change on either side up to a pH of 5 and down to 3.5.

The copper discs used for the tests, furnished by the supplier as cold rolled copper, half hard temper, had nominal thicknesses of #20 B.S. gauge. A precision micrometer was used for measuring the thickness of each disc.

The nickel anode used was a circle cut from 1/8" rolled depolarized nickel sheet, attached to a nickel rod of the same purity (99.9%). Fig. 2 shows the anode and the anode jig used for positioning the

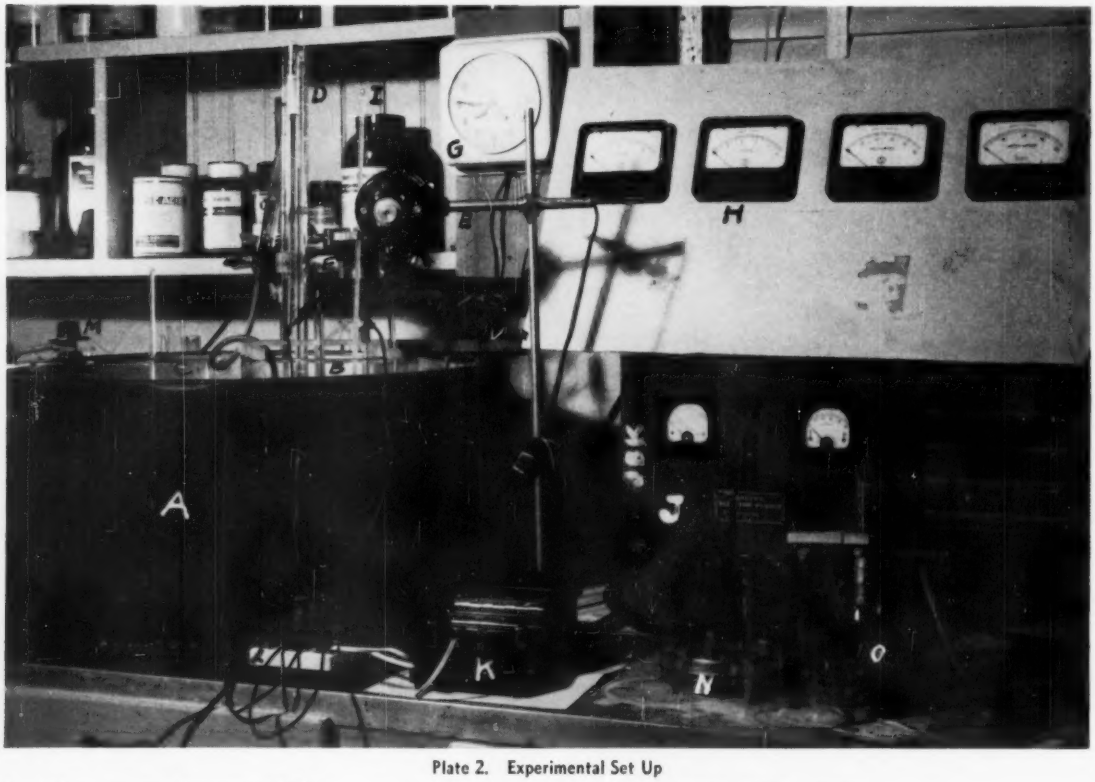


Plate 2. Experimental Set Up

A. Jacketed constant temperature bath.
B. Plating tank, 2 gal. pyrex jar.
C. Tempering tank.
D. Stresometer, supported by rod and clamp.
E. Plating tank stirrer (360 rpm), glass prop.
F. Water bath stirrer.
G. Sweep second clock used for timing experiments.
H. High resistance control voltmeter.
I. Precision thermometer in plating bath.
J. Full wave rectifier, variac controlled.
K. Precision G. E. ammeter for measuring current.
L. D.P.D.T. switch for cutting current in and out and reversing same.
M. Thermostat control.
N. Special jig for electropolishing discs.
O. Special Stresometer cell used with small amounts of plating solutions.

anode to insure uniformity in deposition and distribution of the nickel plate. A test made on a check run with a heavy nickel deposit (0.002″) showed a satisfactory plate distribution as determined by sectioning the disc and measuring the deposit thickness at the center and around the disc edge. A diagram of this distribution is shown in Fig. 3. The thickness of the plate was measured with the precision micrometer which could be read to 0.0001″.

In all tests, except where noted, at least two runs were made. If both came within 10% of each other at a thickness of 0.0005″ and beyond, the run was accepted as good and the values of one or the other was used. Averaged values were not taken because, in the early stages, at thicknesses less than 0.0002″, there could be considerable difference in value due to surface conditions as will be noted later.

In many cases, reproducibility was so good that values beyond the thickness of 0.0003″ came to within less than 5% of each other. In those cases, where results showed a wider margin of difference than 10%, one or more additional runs were made under the same conditions until the two results checked. These were then taken as the accepted values.

Current density and thickness of deposit were controlled by means of a precision ammeter and a variac control on the full wave rectifier. There were only slight occasional fluctuations, and deposit weighings using an analytical balance and a copper sulfate bath indicated that an overall accuracy of about 2%, based on the ammeter control, could be maintained.

Unless otherwise noted the temperature for all tests was 25°C. ± 0.2°. A stirrer motor with a small glass rod propeller, rotating at 360 r.p.m., maintained uniform temperature conditions in the plating bath during the plating operation. If, during the operation of the plating bath, a change in temperature greater than 0.05°C. occured it was corrected for by the use of a temperature change correction factor. It is estimated the overall accuracy of the measurements came to within 10% of the true values.

Relationship Between Residual Stress and Deposit Thickness

It has been known for some time now that the residual stresses in electrodeposited metals vary with the deposit thickness. Much confusion has arisen as a result of this, since many experimenters gave their results for varying thicknesses of deposit. Brenner[10] in a paper describing his Spiral Contractometer, called attention to this fact. The stress is usually high at first and then diminishes to what appears to be a constant value in the neighborhood of 0.001″-0.002″ deposit thickness.

In connection with this subject, a number of test runs were made to determine the nature of the variation of residual stress with deposit thickness. Typical results are plotted in Fig. 5, based on the figures of Table I, for nickel plated out of a 1M nickel bromide solution with 0.5M boric acid as a buffer. Similar figures for a deposit from a commercial copper sulfate bath are plotted in Fig. 6. With the exceptions noted, similar type results were obtained from all plating baths used in these experiments.

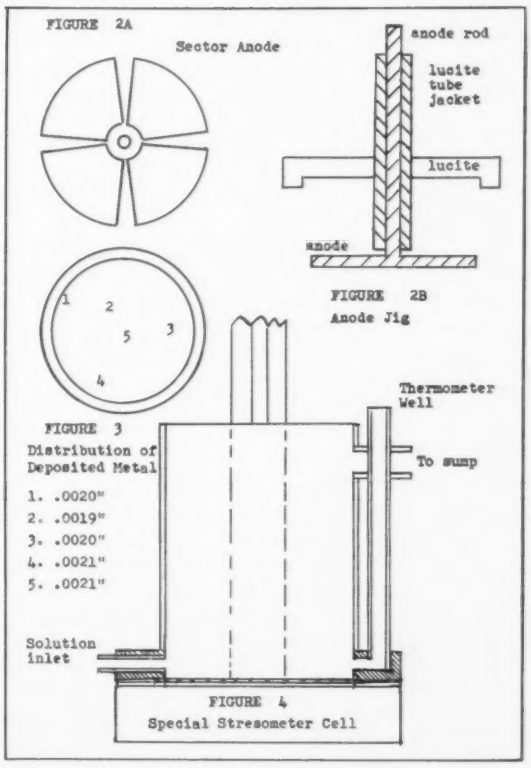


TABLE 1

Deposit made from 1M nickel bromide solution, 0.5M Boric Acid. Disc #1. Temperature 25°C., Current Density, 30 amp./sq. ft.

Deposit Thickness inches $\times 10^{-4}$	*Residual Stress psi*
0.065	+ 34,000
.13	29,100
.26	25,500
.52	23,100
1.04	20,300
1.30	18,900
2.60	16,400
5.20	13,200
7.80	11,800
10.40	11,300
13.0	11,100

+ signifies tensile stress.

TABLE 2

Deposit made from commercial copper sulfate bath, unpurified. Disc #31. Temperature 25°C., Current Density 30 amp./sq. ft.

Deposit Thickness inches $\times 10^{-4}$	*Residual Stress psi*
0.28	+ 6500
.56	5100
1.10	4250
2.80	3170
5.60	2510
11.20	2100
13.0	2050

All results, with a few exceptions to be discussed

in later pages, show this type of variation. Metals other than nickel and copper show this same variation. Rhodium, for example, shows a similar change in stress with thickness[41] as does chromium.[42] However, with these two metals the curves are not always of this type because of cracking developing in the deposits. In all cases, a limiting value appears to be reached after a certain thickness of metal has been deposited.

It has been suggested that, due to increasing grain size, the stress is lowered in this way. Brenner[40] has demonstrated, with a series of micrographs, the change in grain size of electrodeposited nickel as its thickness increases. It is a known practical plating fact that, in ordinary plating solutions, the initial deposit up to 0.0001″ or so, is usually fine grained but, as thickness increases beyond this point, the deposit becomes coarser grained and less smooth.

In considering this phenomenon one almost intuitively surmises that there must be two major factors at work here. First, there is the immediate influence of the basis metal surface in controlling the initial crystal structure for, if there is to be a true atomic bond, the depositing metal must, by some means, conform its lattice to that of the basis metal. Second, the deposit structure must be controlled beyond this, by the nature and content of the cathode film. These two are in closest contact with the metal deposit when it is being formed and must be the controlling factors. It is obvious, however, that the influence of the basis metal substrate cannot last too long, beyond say, a thousand Angstroms or so because the forces do not act over a long distance and the newly arriving atoms, in their desire to take up their own natural crystal structure, must resist these surface forces that control initially. Accordingly, this influence must be rather quickly damped out. Now, the true structure of the deposit makes its appearance and this is necessarily controlled by the nature of the cathode film, i.e., concentration of compounds present, pH, etc. If the conditions in the cathode film remain constant the residual stress in the deposit should remain constant because each new layer of metal is put down under the same conditions.

Based on this premise it is suggested that the average stress in an electrodeposit is given by the empirical function

$$(2) \qquad S_a = A + Be^{-kt}$$

where S_a is the average stress in the deposit at the thickness t, A is the equilibrium stress or limiting value of the stress for the given conditions of operation, B is the stress due to the initial influence of the basis metal surface and k is some constant which expresses the rate of damping, equivalent to the inverse of some characteristic length.

The value of the stress in a small increment of thickness dt at a time a layer t inches thick already exists has been called by Brenner, the "instantaneous stress," S_i. This instantaneous stress was found by Brenner graphically, from his average stress curves,

FIGURE 5

VARIATION OF RESIDUAL STRESS WITH THICKNESS

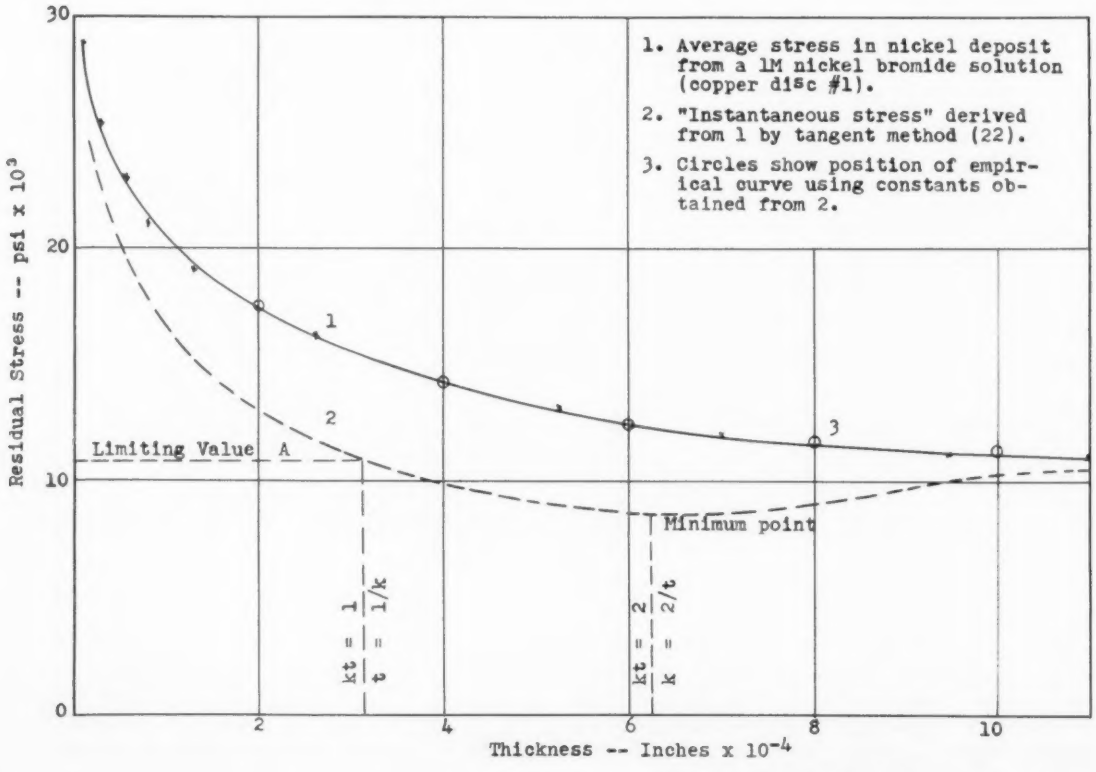
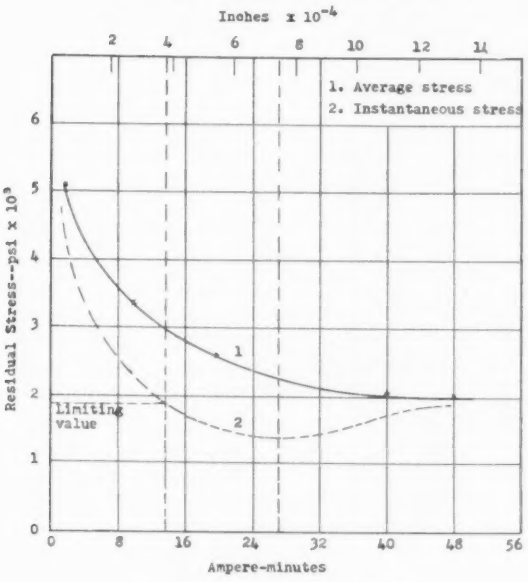


FIGURE 6

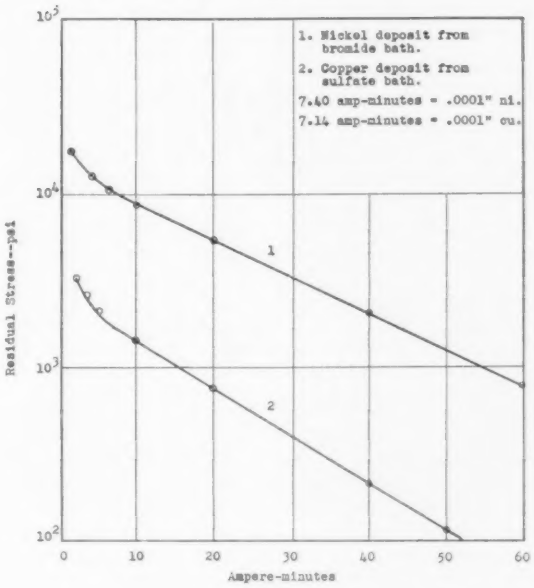
VARIATION OF RESIDUAL STRESS WITH THICKNESS



Deposit made from commercial acid copper bath. Disc #31.

FIGURE 7

VARIATION OF STRESS WITH DEPOSIT THICKNESS



Semi-log Plot

which resemble in form those of Figs. 5 and 6, by means of the well known relationship:

$$(3) \qquad S_i = S_a + t\,\frac{dSa}{dt}$$

If this is done for a number of points a second curve results which shows a minimum value, as can be seen in the lower curves of Figs. 5 and 6. Brenner originally explained the presence of this minimum as being due to a lag in his measuring instrument caused by frictional binding, which is subsequently released and, as an alternate idea, suggested that it might be associated with a stress producing effect taking place in the early stages of plating which is relieved after a period of time. Since the Stresometer is not subject to friction and a plot of the results shows the same minimum, it cannot be due to the first premise.

On the basis of the proposed empirical relationship of equation 2, if we perform the operations on it given by equation 3, we arrive at the value of the instantaneous stress:

$$(4) \qquad S_i = A + B\,(1 - kt)\,e^{-kt}$$

The question is, will this function show a minimum? If we differentiate with respect to t and set the differential equal to zero we find that the function does have a minimum value at $kt = 2$. Examination shows that, whenever there is a simple logarithmic decrement, a minimum will always be produced in the instantaneous curve.

To verify the applicability of the suggested equation, 2, to the stress curve experimentally obtained, as shown in Fig. 5, the value of t was found at the minimum point and k was set equal to 2/t. According to the curve, $k = 2/.00061 = 3180$. Now, by noting that the second term in equation 4 becomes zero when kt is set equal to 1, we obtain the limiting value A. If this is done, A is found equal to 11,000. Using this value of A and a value of S_i from the lower curve, we obtain as the value of B, 13,300. Accordingly, equation 2 for nickel deposits from the bromide solution becomes

$$S_a = 11{,}000 + 13{,}300\,e^{-3180t}$$

Using thicknesses of 0.0002", 0.0004", 0.0006", 0.0008" and 0.001", values of S_a were computed from this equation and plotted back as circles on the actual experimental curve. The closeness of the fit can be seen at once. However, below a thickness of 0.0001", the empirical curve drops away from the experimental curve.

This can be seen more readily if a plot is made of $\log(S_a - A)$ against t. This has been done in Fig. 7. As can be seen, the result is a straight line except in the region below 0.0001". The slope in this region is considerably greater than k and it indicates that the decrement in this region is much greater than the simple logarithmic one. In other words, another mechanism is at work in this region.

This would mean that a third term should exist in the empirical equation to account for the very sharp decrement in the beginning stages of deposition. For practical purposes, however, this is not necessary as stress values are of interest usually only beyond thicknesses of 0.0001".

Accordingly, it is suggested that, in comparing stress values, A, the equilibrium stress for the given conditions of operation should be used as the reference. Likewise, the k value should be given, or the characteristic thickness, 1/k. In other words, two plating baths could be compared logically by a method of this kind.

(To be continued)

Science for the Coatings Technologist

Part IX. Metallic Pigments

By E. S. Beck

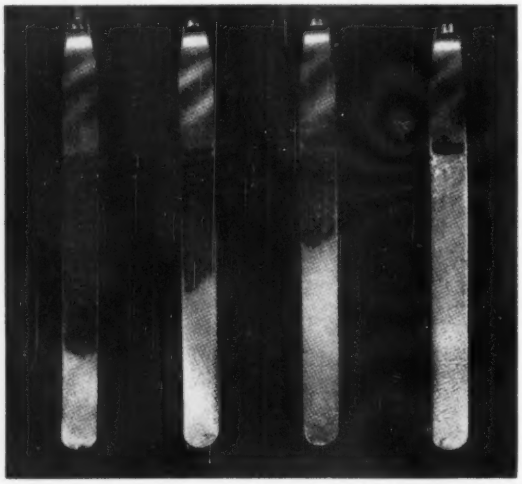
The following article is the first of a two installment series dealing with metallic pigments. The second (and concluding) installment will appear in next month's issue of *Metal Finishing*.—Ed.

ONE of the most useful, popular and attractive types of pigment is the metallic pigment. It is difficult to think of an industry or product which does not use one of the metallic pigments in its coatings for some purpose, from submarines to desk lamps. These ubiquitous materials are available in a wide variety of forms, types and compositions; so that the most suitable material may be selected for each particular application.

There are seven different metals (or alloys) which are used, to a greater or lesser extent in paints. First, and by far the most important, is aluminum. Fairly common are copper, bronze and zinc. Of very limited application are lead, gold and stainless steel. Other subdivided metals exist, and may be used in coatings, but not to the writer's knowledge. Silver is used for conductive coatings; and many metals such as nickel are of value for decorative purposes.

Aluminum

This is not the oldest of the subdivided metals, but it is the most useful and important today in the field of coating technology. While aluminum can be prepared in the granular form, it is invariably used as flakes in the paint industry. The flakes are supplied in two general forms: leafing and non-leafing. They also vary in the size of flakes offered, from extremely coarse (20 mesh) to extremely fine (325 mesh).



(Courtesy Metals Disintegrating Co.)

Fig. 1. Spatula Leafing Test on Several Pigments.

The varying extents of leafing of these four different pigments can clearly be seen. The material on the right shows almost 100% leafing.

Aluminum flakes are supplied in paste form or as dry powder. The pastes are prepared by grinding granulated aluminum in ball mills with solvent and an oily leafing agent, generally stearic acid. Prolonged grinding ultimately converts the particles to extremely thin flakes. The dimensions of the flake are governed by the ratio of the ball charge to the aluminum, the length of grind and other factors. The pastes as made in the mill are quite thin.

After the aluminum has been ground to the proper dimensions, the mill is discharged, and the load is passed through a plate-and-frame filter. In this process, most of the liquid is removed, and a rather dry cake is obtained. Where the final product is to be a paste, the cake is let back in a suitable tank with the appropriate solvent to bring the final paste to the required solids composition.

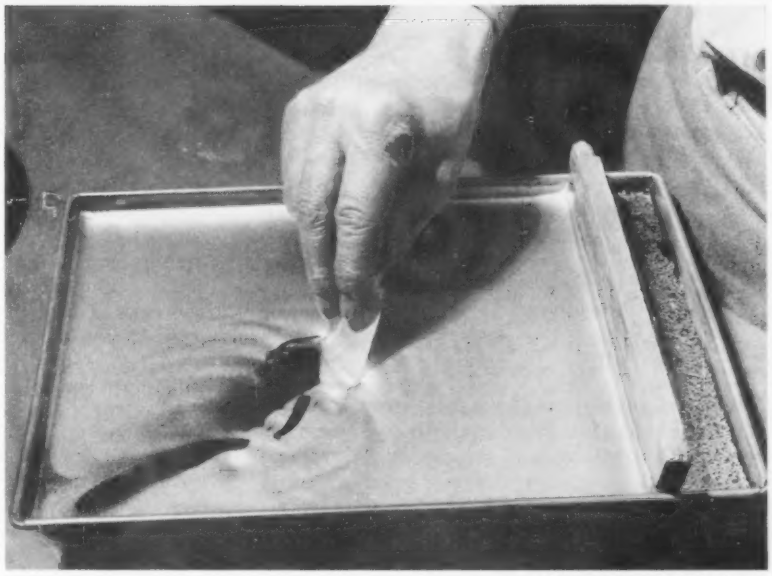
Where the flake is to be sold as a powder, the dried cake is passed to a burnishing mill, where it receives a polishing and is then loaded into containers in the dry form. This process gives an aluminum flake of higher polish, hence increased brilliance and reflectivity. Formulators seeking a high degree of brightness will call for powder or dry aluminum flake rather than paste.

The usage of dry aluminum flake is fairly small in comparison with the pastes, however. This is because of the convenience which the pastes offer. Twice as much aluminum flake can be shipped in a given container as paste rather than as flake. Paste is much easier to work into a formulation than is dry flake. Paste is safer to handle, both in the user's plant and in the aluminum plant. Dry aluminum flake is quite hazardous. Dust explosions and fires can occur all too easily.

Another great convenience of the paste form of aluminum flake is its relative cleanliness. Anyone who has ever weighed out aluminum flake in the dry form will remember the ease with which the flakes suspend in air and are carried far and wide, gradually settling on everything, and depositing a film of aluminum everywhere. Careful was the worker who did not have to visit the shower-room after weighing out a goodly amount of aluminum flake in the dry form. Contrast this with the almost complete cleanliness of the paste form. It is dustless, easily weighed, easily handled, and

easily mixed into batches. Is it any wonder that the majority of paint makers have willingly consented to forego the small increase of brightness obtainable with dry flake in favor of the convenience of the paste form?

Pastes are generally prepared in mineral spirits, which is quite suitable for most architectural uses. This solvent is often quite unsatisfactory for industrial use, however, especially in nitrocellulose or vinyl lacquers. A few grades are available in xylol or high-solvency naphtha. However, one may not find the type one needs for a special use always available in a suitable solvent. In this case, the powder form must be used. There are a few formulations where even xylol or high-solvency naphtha is unsuitable. In these cases, powder must also be used.



(Courtesy Reynolds Metals Co.)

Fig. 2. Measuring the Covering Capacity of Aluminum on Water.

This test consists of measuring the amount of surface which can be covered by the aluminum pigment when it is spread out on water. The particles are dispersed to the point that the film has a thickness of only one flake. The film is kept close-packed without breaks. Only degreased powders and flakes can be tested in this way. The finer the degree of subdivision of the aluminum, the greater will be the coverage. The film of aluminum which is floating on the water is moved back and forth by means of the barrier until maximum area is covered with no wrinkles or breaks. The method is dependably accurate in the hands of experienced technicians. Spreading can run from 10 to 12 thousand square centimeters per gram in the case of coarse flakes to about 30 thousand square centimeters per gram for extra fine lining aluminum.

Certain printing applications are also based on the use of dry flake. In these operations, a tacky adhesive is applied to the work to be printed, and the dry flake is mechanically dusted onto the tacky surface. This produces an extremely brilliant aluminum finish. The less paint vehicle is on the surface of the aluminum, the brighter is the appearance. By this process, if it is carefully done, a layer of completely uncoated aluminum is obtained, hence the extreme brightness.

It was mentioned above that pastes are prepared by grinding the atomized aluminum in the ball mill with solvent and stearic acid. It is the presence of the stearic acid which contributes the leafing properties of the paste or powder, to be discussed shortly. Sometimes non-leafing pastes or powders are needed. General practice is to prepare the material in the same manner, then to remove the stearic acid, and replace it with a deleafing agent. Alternatively, the original paste can be prepared with a deleafing agent instead of the stearic acid. Processing properties are not as good; also production convenience is greatly aided by using a single grinding aid.

Leafing

Leafing is the tendency of flakes to float up and form a continuous overlapped surface. This has been compared to the scales on a fish or the shingles on a roof. The stearic acid on the surface of the leafing flakes contributes a repellancy to the flakes which aids the flakes in rising to the surface to produce the chain-mail leafed effect.

Leafing is the phenomenon which contributes the shiny, brilliant metallic effect to this type of film. In general, the coarser the particles of aluminum flake, the brighter will be the effect. Increasing fineness, on the other hand, gives greater gloss and smoothness of film.

Leafing contributes more to the film than just a metallic appearance. The overlapping shingle effect is not confined just to the outer layer of surface; but appears to be present all the way through the film. This contributes valuable properties to the paint. The armor-like linking of platelets of aluminum metal provides an excellent shielding and resisting layer to the paint. Water, or other deleterious substances, has a longer effective path to travel to get through the paint film. Light, on the other hand, is effectively turned back by reflection at the first layer.

This sealing action contributes great durability to the film. Since the outer surface is substantially pure aluminum metal, with little or no vehicle, the durability is almost independent of the nature of the vehicle used; this is, provided the vehicle can at least supply enough adhesion to keep the film on the substrate. It is frequently, and truly said, that two coats of leafing aluminum paint will outlast any other protective coating.

This effect is most dependably obtained by use of the coarser grades of aluminum flake. As the particle size is reduced, the mean path moisture must take to get through the film is shortened, so the protective qualities grow less and less. With extremely small particle size aluminum flakes, the protective qualities may go as low as half those of the coarse flakes. The shorter free path for water is in part owing to less effective

leafing, with a larger number of particles in random positions other than flat in the film. It is principally due to the increased number of joints or laps per unit of surface. These overlaps are the points of weakness of this type of film. It is here that moisture and other destructive materials can penetrate.

The sealing action is two-directional. Aluminum coatings not only seal off the substrate from the elements, but also, seal in migrating materials. If bleeding substances must be sealed in, aluminum materials often will do an excellent job. This is the principal justification for the use of aluminum sealers on new wood. Aluminum sealers have one drawback, however, the soapy, slick surface is not always easy to recoat, and adhesion problems are frequent.

Aluminum flakes, even of the most strongly leafing variety will not leaf in every liquid. In fact, there are relatively few types of paint vehicles in which aluminum will leaf. Practically the only general class of materials which give dependable leafing are the varnishes, from very short to very long. Tung oil varnishes give excellent results, although linseed oil is not far behind. The color of the varnish is not important, since the leafing of the aluminum completely hides the vehicle color. In fact, even black vehicles, such as gilsonite or asphalt can be used as satisfactory aluminum leafing vehicles with no difficulty.

A few individual alkyds can be used as leafing vehicles, especially if the mixed enamel is not to be stored too long. Some straight gum solutions, such as Cumar can also be used. But, in general, varnishes or varnish type materials give satisfactory leafing for only a single day with package leafing type materials. Vehicles of high acid value must be avoided, as must lead drier. Cobalt is the safest drier for use with leafing aluminum. Solvents are not too important, although it has been shown that aromatic solvents, especially xylol, are excellent for leafing.

If a certain type of vehicle is required for performance purposes, it may be found that the aluminum will not keep its leafing in it. This need not eliminate the vehicle from consideration, provided it will sustain leafing for some reasonable period, sometimes only a day. In these cases, the aluminum paste can be packed in a separate container, and mixed in as the product is used. If the mixture will keep its leafing for only a short time, it is essential to mix up only enough to be used within that safety period. With many vehicles, especially alkyds, the mixture will retain its leafing for weeks or months quite satisfactorily; but still is not good for several years, which is the safe time for shelf goods.

As a mixture loses its leafing powers, the color of the applied film changes from a brilliant silvery metallic appearance to a leady, dull gray color. This leady, gray appearance is that of fully deleafed aluminum. The actual metal particles have not changed in their individual appearance, but they no longer leaf to the surface to form the shingle effect. Instead, they are now dispersed at random throughout the film. Most of them are on edge or at some angle other than flat. This gives the gray or dark appearance. As will be shown below, this is not always undesirable. In fact, much aluminum for paint work is sold as non-leafing.

A number of procedures have been developed for measuring the ability of an aluminum to leaf in a given vehicle; or to evaluate the leafing properties of a vehicle with a standard leafing aluminum. These all depend upon measuring the height to which leafing rises on a spatula which has been dipped into the mixture. Of course, the mixtures are prepared under standard conditions for comparative purposes. Federal Specification TT-A-468 outlines a procedure using a cumar resin solution as the vehicle. From one to three grams of the aluminum in question are mixed into the vehicle, using 25cc of the vehicle. The quantity of aluminum is determined by the type which is under test (the specification covers three powders and three pastes). A spatula of standard dimensions is immersed, withdrawn, hung for three minutes, and then measured for depth of immersion and height of leafing. The ratio is converted into a percentage. The types of aluminum covered by the specification are required to leaf from 40 to 55 per cent under these test conditions.

Non-Leafing Aluminums

Where leafing aluminums are used, the object is to obtain a completely leafed, metallic surface. Enough aluminum must be introduced into the paint to provide a continuous, completely leafed surface. A paint made with insufficient leafing aluminum provides an ugly, mottled surface. It is generally considered that 1½ to 2 pounds of aluminum are required for this purpose.

Non-leafing aluminums are not so critical as to quantity of metal which must be present. Since a complete metallic surface is not required, the amount employed can vary from less than an ounce to perhaps one pound. In general, non-leafing types are used with colors or dyes, where the aluminum provides a glitter or metallic sparkle throughout the film. Leafing types are very difficult to color because the hiding power of the aluminum is so extremely high. Where leafing types must be colored, as in the case of two coat systems, it is generally advisable to use a soluble or transparent coloring material which will dissolve in the vehicle. In this way, the vehicle around the flakes will become colored, and impart some color to the mixture.

Non-leafing types are relatively easy to color, and a wide variety of attractive effects can be obtained from their use. Since there is no loss of leafing to be considered, the most useful paint properties are found in the non-leafing aluminums. Painted objects can be handled without smudging. Leafing aluminum paints rub off so badly that only objects which are not to be handled can be painted with them. This is because the brilliant effect is only obtained by causing the aluminum to leaf up to the surface with as little binder as possible to cement it down. As a result, the aluminum cracks or rubs off very easily. Overcoating with a clear is not a very good answer, either, as much of the brightness is lost in this way. There is no rubbing off with non-leafing aluminum.

A compromise between brightness and freedom from rubbing off can sometimes be accomplished by using a blend of leafing and non-leafing aluminums. Non-leafing aluminum formulations generally spray well but are difficult to brush, harder to roller-coat, and almost impossible to dip. When applied in any man-

ner but spraying, non-leafing formulations tend to show streaking, mottling and silking. Although in some cases this can be overcome by strenuous measures, it is more often impossible to completely eliminate.

Coatings made with leafing aluminum should be formulated with fairly slow solvents, in order to allow enough time in the wet state for the aluminum flakes to float up to the surface. If the solvents are so fast that the film sets up too rapidly, there will be unsatisfactory leafing. In the case of non-leafing aluminums, the opposite conditions apply. It is necessary to use fast solvents in this case, for flooding will occur if the film has much mobility. In fact, non-leafing materials are generally sprayed dry, in order to fix the aluminum in place as it hits the surface to be coated. In this way, a bright, color-uniform appearance can be obtained.

Non-leafing coatings are generally made using deleafed or non-leafing aluminum pastes or powders. It is not necessary to start with non-leafing aluminum, however, if a non-leafing vehicle is used. The typical non-leafing vehicle will destroy the leafing of an aluminum within 24 hours. Some formulators find an advantage in the use of their own deleafed paste, from the point of view of appearance, especially brightness, but the writer has been unable to confirm this in his own laboratory.

Metallics

This popular and widely-used class of finishes is based upon the use of non-leafing aluminum. The coating is also known as metalescent or iridescent. It consists essentially of a dispersion of non-leafing aluminum flakes in a colored vehicle (rarely, an untinted vehicle). While the amount of aluminum present may vary, there is not enough to produce a continuous, solid aluminum appearance. Instead, a discrete, glinting type of effect is sought.

Opaque pigments are seldom used in this type of coating. This is because the proper effect is obtained by seeing into the film. Light is reflected from the aluminum particles within the film as well as at the surface. Hence, transparency is required for the best effects. Another undesirable effect of opaque pigments is to produce a color change on the "flop." This refers to the fact that metallics can be quite variable in color, depending on the angle of view. This is owing to the partial transparency, as opaque finishes (with no texture) appear the same shade from all angles. The most common way of evaluating the angular color uniformity is by inspecting panels held in the hand at an angle or position roughly parallel to the face; then turning them down so that the glance takes a long angle, perhaps 10 to 15 degrees from the surface of the panel. This drop in the angle of view is the origin of the term "flop."

Well-formulated metallics, with a satisfactory degree of transparency, or translucence, will show little or no color change on the "flop." Aluminum pigment by itself in a metallic formulation shows no change in color on the "flop" but darkens on the long view. This effect is overcome by judicious choice of color pigments. If opaque pigments are present in significant amounts, very marked color changes can occur. White is perhaps the worst opaque pigment to encounter in metallics. Even a relatively small amount can introduce a very objectionable milkiness together with a very bad color change on the "flop."

Marked changes in color of many articles on the "flop" are undesirable from the esthetic view. Filing cabinets and television sets, for instance, would not match side to top, because of the difference in angle of view. The color would also look different from one side of the room to the other, and to the viewer standing as opposed to one sitting.

As pointed out above, non-leafing formulations perform best in quick-setting compositions. Nitrocellulose lacquers are ideal for quick-setting coatings and have proved ideal for metallics. The nitrocellulose metallics have become the standard of comparison for this type of coating. They produce a brightness and beauty of appearance which other types of compositions cannot equal. Of course, there are very many cases where nitrocellulose lacquers are unsuitable. In these cases, baked synthetics or other vehicles are used, and with good results. But they do not have quite the appealing brilliance that nitrocellulose metallics do.

Hammered Finishes

A closely related family of coatings is the *hammered finishes*, sometimes called *hammertones*. In this type of coating, the goal is to obtain the appearance of hammered or beaten metal. The formulation is essentially similar to that of a metallic, except that the pattern is imposed on the film in some way.

The popularity of hammered finishes is partly based on the fact that these materials, because of their textured surface, can be used on fairly rough metal. The overall effect is rather good, and the roughness, file marks, and other imperfections, do not show up as glaringly as they would through a smooth film of equal gloss.

Another interesting feature of the hammered finish is the texture itself. Some objects make a better appearance if their surface is broken up to a slight extent. The hammered finish provides a very acceptable means of doing this. Unlike the wrinkled finish, which can do very much the same thing, the hammer is easy to clean, and does not collect dirt.

The first hammered finishes were a two-step process. The first was to apply a coat of a metallic topcoat. This coat did not have to be put on as dry as a normal metallic. The hammering process concealed any reasonable amount of flooding which might be present. After the finish had set up for a short time, it was spattered with a fine spray of hammering solvent. This was a fast-evaporating material, such as ethyl acetate or acetone. There was a certain knack to applying the hammering solvent, which took a little practice to acquire. A special gun was best used, and the size of the droplets was fairly critical. The pattern developed almost instantly, and was quite attractive, indeed.

This type of hammered finish has become obsolete. Users of hammered finishes have all changed over to the newer and simpler one-coat materials. These no longer require the second step, of spattering with hammering solvent. Instead, the pattern is produced almost as soon as the coating is applied, by internal action within the film. The one-coat hammers are easier to

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Cold Chromium Plating in Russia

By A. J. Steiger

WITH the object of more efficient chromium plating of large punch-and-die sets, Russian machine-tool specialitsts have been employing an electrolyte for cold plating which, reportedly, requires one-third to one-fourth of the current density of the conventional electrolyte and has better throwing power. The best composition is said to be 250 g./l. of chromic acid and 4 g./l. of ammonium fluoride. Plating is done at a temperature of 15 to 25° C. and current density of 8 to 12 amp./dm.^{2}

Reportedly, the method has been used with success in plating a 1500 x 1500 mm punch and die with more than two square meters (21.5 sq. ft.) of surface, produced in Kharkov. The Russian report on the new process gave the following details.

An electrolyte containing 250 g./l. chromic acid and 3 to 8 g./l. ammonium fluoride was studied. It permits plating at a temperature of 20 to 30°C. With increase of ammonium fluoride content, the minimum current density at which chromium deposition begins rises, as is evident from the table below.

Chromic Acid g./l.	*Ammonium Fluoride g./l.*	*Minimum Current Density amp./dm.^{2}*
250	3	5
250	4	5
250	5	7
250	6	10
250	8	20

It was established that introduction of sulfuric acid anion into the electrolyte impedes deposition at room temperature. Sulfuric acid content up to 0.3 g./l. does not affect the plating conditions, as to temperature, current density and current efficiency. With sulfuric acid content exceeding 0.3 g./l., in the presence of ammonium fluoride, higher current density (order of

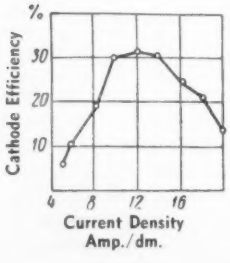


Fig. 1A

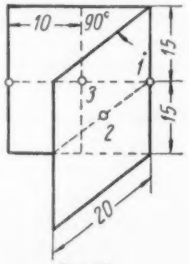
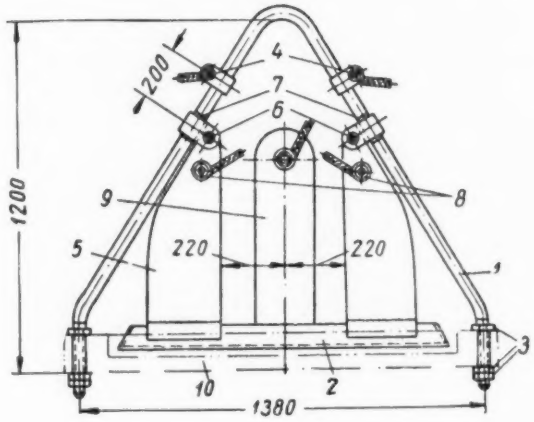


Fig. 1B



a)
Fig. 2A

30 to 35 amp./dm.^{2}) and higher temperature (45 to 60°C.) are required. Therefore, when it is necessary to do chromium plating at lower current density, the sulfuric acid content of the ammonium fluoride bath must not exceed 0.3 g./l.

Since the investigation was conducted to develop an electrolyte that permitted use of minimum current density, an electrolyte composed of 250 g./l. chromic acid and 4 g./l. ammonium fluoride was tested. It will be seen from the graph (Fig. 1a) that the cathode efficiency reaches a maximum (33 per cent) with current density of 10 to 13 amp./dm.^{2} The throwing power was determined by the bent cathode method with subsequent determination of the plating thickness at three points of the cathode's inside surface (Fig. 1b). The ratio of the average chromium thickness at the cathode edges at points 2 and 3 to the thickness on the inside of the angle (point 1) characterize the electrolyte's throwing power. If this ratio K is equal to 1, then uniform distribution occurs on the surface of the bent cathode; the greater the magnitude K, the poorer the throwing power. For an electrolyte consisting of 250 g./l. CrO_3 and 4 g./l. NH_4F, at 10 amp./dm.^{2}, and 20°C., the average magnitude of K equals 2.6; for an electrolyte of 250 g./l. CrO_3 and 2.5 g./l. H_2SO_4, at 35 amp./dm.^{2}, and 55°C., the average magnitude of K equals 4.7. Thus, the cold electrolyte has considerably better throwing power than has that of the standard sulfate bath.

It was established that the hardness of the deposits

from the old and standard plating processes is identical and, measured by microhardness instrument, is within the limits $R_C = 67$ to 70. The investigation established that when the chromium deposited from the cold electrolyte exceeds 35 microns (0.0014″), formation of dendrites is observed. Since the plate thickness in compression molds and dies usually does not exceed 30μ (0.0012″), this feature is not a drawback to use of cold electrolytes in these cases.

Shown in Fig. 2a and 2b are the fixtures used for chromium plating a large die and punch. Two steel stirrups (1) made of any grade carbon steel serve simultaneously for hoisting and job set-up, and for feeding the current to the part (10) being plated. The total area of the stirrup cross section must be adequate for the required current and is calculated on the basis of 1 mm² cross section of steel conductor for 1.5 amperes. Reliable electrical contact between the stirrups and die (10) is achieved by means of steel nuts (3). From the current rods to the stirrups, current is fed by means of brass clamps (4). The anode (2) of sheet steel 3 mm thick is hung on the stirrups by means of braces (5) and clamps (6). The anode is insulated from the stirrups by rubber pad (7).

The current to the anode is fed through clamps (8). Brace (9) is welded to the middle part of the anode to secure uniform current feed. Removal of gases liberated during plating is facilitated by the anode having holes 7 mm in diameter, arranged in checkerboard pattern. The anode's pointed edges are directed to the punch and die corners, which ensures uniform plating of the whole surface.

Parts are prepared for plating by usual methods. After the die, set up in the fixtures, is immersed in the plating bath, anodic etching is effected at 7 to 10 amp./dm.² Treatment time is 15 to 25 seconds. By means of a double pole-double throw switch, the die is switched over to the cathodic side, and chromium plating is carried out at current density of 10 amp./dm.² and 15 to 25°C. Since, with addition of ammonium fluoride, the electrolyte has better throwing power than the usual electrolyte, it is not necessary to apply increased current at the beginning of the process in cold chromium plating.

The cold chromium plating process made it possible, in plating 2.5 m² of surface (27 ft.²), to employ one motor-generator set of 5000/2500 ampere, 6/12 v, as

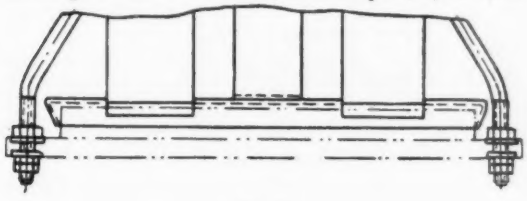


Fig. 2B

direct-current source. It should be noted that, after preparation of the bath, it has to be dummied at cathode current density of 7 to 10 amp./dm.² for 5 to 6 hours, following which actual chromium plating can begin.

The baths for cold plating do not have heating units and are, therefore, simpler to construct than conventional baths. The steel anodes can be used only once since they tend to dissolve during the plating process. For parts of large dimensions, heavy lead anodes cannot be rigidly fixed; therefore, in cases of production plating it is necessary to use lead-plated steel anodes, with lead deposit not less than 0.5 mm in thickness.

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apply, in the sense that one operation has been eliminated. But they are considerably more temperamental than are the two-coat materials. Failure to hammer on occasion is not unknown. Variations in pattern can occur with changes in film thickness, wetness of film, and other application variations.

The bold hammer pattern which can be obtained with a little practice with the two-coat system is rather difficult to produce in a one-coat hammer. Formulations have been developed which yield the large pattern under good conditions, but obtaining this pattern steadily in production is another matter. The smaller pattern is more foolproof, and most users are settling for this today.

The hammer pattern of the one-coat material was first produced by means of a deliberate incompatibility in the vehicle of the coating. It was soon found that cooking normal materials, especially short alkyd resins, to an abnormally high degree of polymerization would produce useful hammered effects. Both styrenated alkyds and epoxy esters have also been found useful as one-coat hammer vehicles. These are two highly polymerized vehicles, it might be pointed out.

It would seem that a very high degree of polymerization is necessary for decent one-coat hammer patterns. This type of vehicle has relatively poor atomization and flow properties. And to get best results, coatings must be sprayed at viscosities higher than used for ordinary spraying materials. While some improvements have been made recently in spraying properties, it would seem almost a matter of definition that one-coat hammers do not spray well.

The use of silicone oils as aiding in hammer pattern formation has become almost indispensable. There are a number of these products available. All are used in very small quantities. They aid very markedly in obtaining a sharp, distinct mark. It is questionable if the one-coat hammer coating could have developed to its present wide use without the silicones.

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FINISHING POINTERS

Chromium Plating Thickness

By J. B. Mohler

THE success of a chromium plated part depends on the proper thickness of the deposit. For decorative plating the thickness is essentially that required to adequately cover the part. A minimum thickness of 0.01 mil is commonly specified. The complete specification includes an undercoating of copper, or copper plus nickel, which may be from 0.1 to 2.0 mils. The undercoating, plus the chromium, will provide a maximum of protection from corrosion, wear, and staining. Heavy undercoatings are used for outdoor applications, whereas lighter undercoatings, where wear and corrosion are at a minimum, are applied for indoor applications. Where wear and corrosion are at a minimum, as for dry, indoor, ornamental applications, a thin undercoat will be satisfactory. Regardless of the consistency of the specifications of 0.01 mil minimum for decorative objects, one cannot help but wonder at the remarkable service of such a thin coating. This points up the fact that chromium provides a corrosion-resistant, wear-resistant, stain-resistant surface.

Deposits of chromium, heavier than the minimum specified, have been used for decorative work. However, the usual practice is to use an undercoat as the most economical means of preparing the surface for "flash" chromium plating. If it is desirable to buff the chromium as a final operation, or to deposit a soft buffable chromium for processing reasons, then a heavier deposit will be necessary. The deposit should be sufficiently thick to withstand the buffing operation without cutting through the chromium. Here the thickness is again essentially a minimum for decorative purposes.

For engineering purposes the so-called "hard" or "industrial" chromium is used. Hard and decorative chromium are essentially the same. The terms are based more on habit than on actual differences in properties. One can favor the hard range, which is not the brightest range in depositing chromium, but the difference in properties of hard chromium and bright chromium is not great. For industrial chromium plating, hardness and low friction are important. The combination of these two properties account for the excellent wear resistance of a chromium plated part. Why then is thickness important?

For cutting applications, as for a tool to cut steel, a low friction surface is essential. Many cutting tools wear at the cutting edge because of the generation of heat just behind this edge. Friction in this area causes heating and poor tool life, due to rapid wear. A low-friction surface reduces this effect. Also, a low-friction surface reduces or avoids sticking or galling of metal chips in this same area. Chromium thicknesses in the range of 0.02 to .05 mils have been very successful for such applications. Thicknesses for cutting tools, of 0.10 mils and greater have caused trouble due to fracturing of the chromium at the cutting edge. Such fracturing takes place when the tool is ground or when it is used. In either case it results in ragged cutting.

When chromium is deposited, it will form rounded surfaces over a sharp edge. This limits the thickness that can be applied for a cutting surface on a file. A chromium plated file will cut as well as an unplated file. However the chips or filings fall away from a plated file. The result is that a very thin deposit will extend the life of a file. A thin deposit will reduce the cutting efficiency by a negligible amount while greatly extending the life. The rule is to deposit just enough chromium to color the surface. A few minutes of plating is generally best.

Relatively thin chromium deposits work well on dies where wear is not heavy. Deep drawing, stamping, shearing, and blanking dies are not subject to heavy wear or abrasive action. A low-friction surface is more important than wear resistance. Consequently, thicknesses in the range of 0.2 to 1.0 mil are common. The same thicknesses are successful for molding plastic dies. An advantage of thin chromium is that it can be deposited as a final finish.

Forming dies generally require a little heavier deposit in the range of 1.0 to 2.0 mils. Large dies that do heavy work may require deposits up to 10 mils. The thicker deposits are necessary for wear resistance at a surface doing heavy work. Usually, for such heavy deposits, it is necessary to overplate and then grind the deposit to size. Heavy chromium cannot be deposited with sufficient uniformity for precision parts. Therefore 1.5 to 2 times the desired thickness is frequently deposited to allow for grinding stock. Good chromium plating practice and proper stress relieving are essential for successful plating of such deposits.[1]

For working surfaces, the thickness of the deposit is generally about in proportion to the size of the equipment. For the same size, surfaces that do heavier work require heavier deposits. For small pump shafts 0.5 to 1.5 mils are satisfactory. For large shafts 4.0 to 5.0 mils may give the best service. For hydraulic equipment, where a shaft slides on a packing, 0.5 to 3.0 mils give successful service.

For large rolls and heavy operating equipment 10 to 15 mils will be found best.

Even the heaviest practical chromium thicknesses are not sufficient to resist crushing forces. Deposits of 10 to 15 mils do not appreciably add to the strength of the part. The chromium surface is not expected to be helpful where deformation or failure of the part due to excessive pressure is a problem. The strength of the part depends on the underlying metal, and the

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New Vinyl Paint Facilities At Poughkeepsie IBM

By Henry D. Bowen, Jr., *Technical Engineer, I. B. M., Poughkeepsie, N. Y.*

Mr. Bowen graduated from Lehigh University, Bethlehem, Pennsylvania, in 1950 with a B.S. in Chemistry. Additional technical experience includes a year of research work in Lehigh's chemical laboratory and several years as a planner in the major appliance division of a large electrical manufacturer. During these years, Mr. Bowen has accumulated paint application knowledge, especially as concerns large scale paint installations that process a wide variety of parts.

Since coming with IBM he has concentrated his attention on the installation and operation of Poughkeepsie's new paint facility, the description of which he has authorized.

In order to keep pace with present day production requirements, many manufacturers' paint finishing cycles have, of necessity, been modified, reconstructed, or set-up anew. In the process, types of finishes, production needs and a multitude of other factors were carefully considered before final decisions were made.

The following description shows how one such company not only solved their own immediate painting problems with their new paint room, but also provided a finishing area which, because of its versatility, will readily permit future expansion and adoption of newer finishes as the needs arise.

—Ed.

OVERLOAD in the painting department, due to increased production, has plagued many manufacturing plants recently. At IBM's Poughkeepsie plant, capacity problems also developed. The situation was further aggravated by increased repainting caused by a machine modification program and by the adoption of a new vinyl finish, which required an additional painting and baking cycle. To solve this growing problem at Poughkeepsie, an entirely new painting installation was constructed, providing the increased facilities and capacity required. This installation was put in operation during 1957.

This article will describe the old paint shop and its problems, the new vinyl spray with its advantages and application, and the new paint shop with its equipment, flow, and relative advantages.

The old paint shop, rapidly becoming inadequate, was housed in a section of a building containing several other unrelated operations. Raw parts were delivered as needed from outside warehouses, since most of the limited adjacent storage areas were needed for rejects, damaged parts and supplementary operations such as sheet metal repair and masking. Material flow was further hindered by more than 1500 different parts received for painting, by production schedules ranging from one per month to 120 parts per day. The parts ranged in size from a few square inches to covers 6 ft. x 6 ft. and cabinets 6 ft. x 2 ft. x 3 ft., and by four different materials — steel, cast iron, zinc and aluminum.

Three conveyors were used in the old paint shop. One ran at 6 feet per minute and was loaded at the only point directly connected with the painting operations, which was outside the paint shop enclosure. This conveyor carried the parts through the phosphating machine to unload areas of the two paint conveyors. The main conveyor operated at 10 feet per minute and passed through a 24′ prime booth, a 36′ finish booth and bake oven. The second paint conveyor, operated at 3 ft. per minute, passed through a 12 ft. booth and bake oven. Two cycles were required for a complete prime and finish coat. After baking, the painted parts (coated with an alkyd wrinkle finish) were carefully wrapped, removed from the enclosure and sent to sub-assembly areas. All paint materials were sprayed from pressure pots in open end booths. Air makeup was inadequate for exhaust, causing negative pressure to develop in the room. Subcontracting of wrinkle painting to vendors helped relieve the load; however, the adoption of the new paint with its extra cycle prevented most subcontracting and excessively overloaded the old shop.

The new paint is a textured vinyl plastic finish resembling pebbled leather and has a dry film thickness of 10 to 12 mils. The material is characterized by a high solids content, minimum 60%, which allows greater film thickness per pass with no sagging. Also characteristic of the material, is a high abrasion resistance, the Tabor factor being 35, with C.S. 10 wheel for 1000 cycles. In addition, the vinyl has a high resistance to acids, alkalies, perspiration, inks and chemicals. The vinyl material will also be used to finish covers formerly made of vinyl clad steels. This change will allow greater flexibility in design and a lower final cost while retaining the high abrasion and corrosion resistance of the coated materials.

Use of this material will result in savings estimated to be in excess of $175,000/year. This savings is due to reduction of painting rejects, reduction of damaged covers during transit to assembly areas, reduction of field service required for damaged paint and elimination of vinyl clad covers. Additional savings

will be realized in less work to remove surface defects before painting, less color and appearance matching problems and reduced handling and packaging costs. The vinyl material is applied using standard spraying equipment and low cost solvents. The parts to be sprayed are first prepared by cleaning and phosphating in a 5 stage spray unit as follows:

1st stage—Alkali cleaner for 1 minute at 160°F.
2nd stage—Hot water rinse for 1 minute at 150°F.
3rd stage—Phosphate for 1 minute at 140°-145°F.

This phosphating bath must handle all four types of metals, producing a minimum coating of 150 milligrams per square inch.

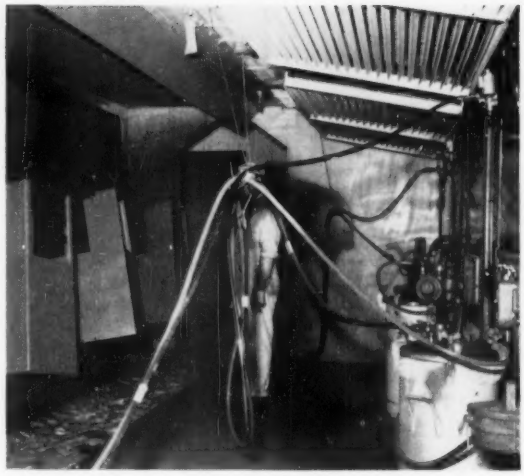
4th stage—Cold water rinse for 30 seconds.
5th stage—Chromic Acid rinse for 1 minute at 150°F.

The parts are dried and an air drying flash primer is applied to all surfaces. The primer is reduced 1 to 1 with thinner to an approximate viscosity of 17 seconds in a #4 Ford cup, then applied to produce a thickness of ½ to ¾ mil wet. Following an air dry of 2-3 minutes the first coat of vinyl paint is applied on exterior surfaces to a wet film thickness of 8-10 mils. The first coat material is reduced 4 parts vinyl to one part thinner resulting in a viscosity of about 45 seconds in a #4 Ford cup. After a 1 minute minimum air flash, the parts are baked for 6 minutes minimum at 200°F. ± 10°.

Upon cooling, the second coat of vinyl is applied to a wet film thickness of 8-10 mils. This material is reduced 8 parts paint to 1 part thinner with a viscosity of about 90 seconds in a #4 Ford cup. After a 1 minute air flash, a texturing agent is sprayed which controls the texture and gloss of the cured finish. This agent, a mixture of solvents, is applied as received, with a viscosity of 15 seconds in a #4 Ford cup, using a mist coat of fine uniform drops. An air flash of 2 minutes then follows after which the parts are given their final baking. This baking schedule consists of 6 minutes minimum at 200°F. ± 10°, followed immediately by 8 minutes minimum at 345°F. ± 5°. Upon cooling, the parts have completely cured films of vinyl paint with a thickness of 10-12 mils.

Inside view of paint shop enclosure showing first coat spray booth on left; entrance and exit of oven for first bake in the rear center.

The pinwheel shown above each conveyor hook is for anticipated future use of automatic equipment.



View of inside of first coat spray booth showing use of recirculation line for major color and pressure pots for those colors which have lower consumption requirements. Also shown is one of the many irregularly shaped parts being finished.

In designing the new paint shop, flow, capacity and equipment needs for vinyl paint were considered. These needs resulted in a modern installation, with an area of about 22,000 sq. ft., the largest to date for the application of textured vinyl paint. Electrostatic methods of paint application were studied but were rejected because the large variety of shapes and sizes together with low production of many items showed the technique to be unfeasible at this time.

To achieve the desired aims, the painting department was moved to another building. All new equipment was purchased and the paint shop was made the hub of a large storage area. One section of the storage area adjacent to the load point of the paint conveyor is used to hold the day's requirements of raw parts. Another section is used as an unload area. In another part of the building, a storage area larger then the paint shop will be used to store the full inventory of raw parts, still presently distributed throughout several warehouses. This arrangement achieves a steady efficient flow of parts to and from the paint shop. Many of the production scheduling problems, previously encountered, will be eliminated since parts will be immediately obtained as required.

A four inch, continuous monorail conveyor, 1384 ft. long, is used to convey the parts through the painting operation. The conveyor operating at 12 ft. per minute has one load point and one unload point, thus eliminating all intermediate transfer points. Swivel type hooks with 16-inch centers are used for hanging parts. In all practical cases special racking is provided; however, on low production items, S shaped wire hooks are used.

Parts hung on the conveyor first pass through the cleaning and phosphating unit, then a dryoff oven for 3 minutes at 300°F. After a 9 minute cooling period, the parts are carried into an enclosure which separates the painting operations from all other areas. The

enclosure is pressurized using filtered air from a make-up unit on the roof, capable of providing 144,000 c.f.m. of air and having heating elements to maintain a 75°F. minimum temperature.

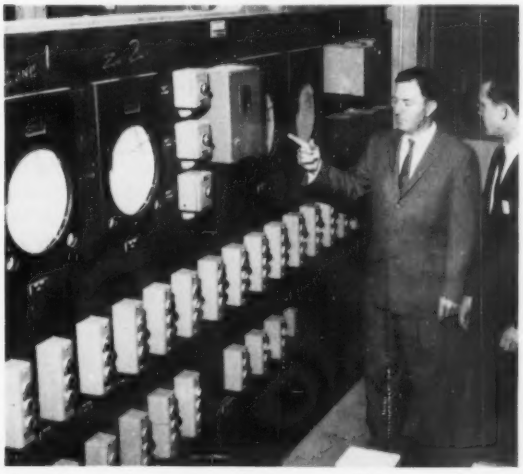
After entering the enclosure, the parts are conveyed through two 12 foot prime spray booths. Each booth is a water-wash type, enclosed, well lighted and supplied with a good flow of air to carry the overspray from the two spraying operators to the water curtain. The water in the booth is constantly recirculated through a continuous filter to remove the floating paint and reduce cleaning requirements. The two booths, next to each other, face opposite directions; thus when a large part, requiring hanging on two conveyor hooks passes through the booths, both sides can be painted without turning the part.

The part then continues through the remainder of the cycle passing through two 40-foot spray booths (of design similar to the prime booths) for the two coats of vinyl paint, through the texturing booth, which is a dry type since only solvents are used, and through the oven.

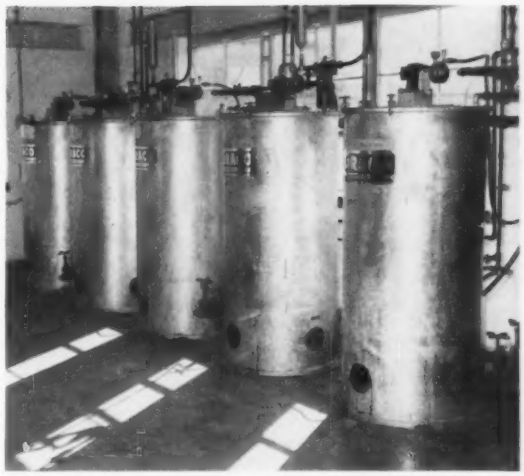
Although two separate baking schedules are required for the vinyl paint, only one oven is used. This is accomplished by dividing the oven into two zones, each having its own heating unit. Zone #1 is maintained at 210°F. and zone #2 at 345° F. A part receiving the first coat of vinyl paint passes through zone #1 for 8 minutes, then leaves the oven. After the second coat vinyl is applied, the part again enters zone #1 for 8 minutes, then goes through an opening into zone #2 for 20 minutes.

The oven, remote-fired by gas operated heating units, is on the roof of the building connecting with the enclosure through inclined tunnels. This location was chosen to eliminate the need of floor space for the ovens, to minimize dissipation of heat into the working area and to increase thermal efficiency by using the change in levels as a heat seal.

After the final bake, the part passes through a cooling tunnel for 5 minutes, where forced ventilation is used to reduce the temperature of the part for safe handling. At the unload area the parts are removed from the conveyor and placed in containers or racks for movement to the sub-assembly areas now located in the same building.



View of central control panel showing pushbutton stations for motors and pumps, oven temperature recording controllers and gas oven safety indicators.
Mr. Raymond J. Burch, (left) Manager of the Paint Shop is shown in discussion with Mr. William A. Dick, Jr. of the Plant Engineering Department.



Part of paint circulation room showing some of the 120 gallon paint mix and circulation tanks.

The new installation minimizes handling both of parts and paint materials. The storage tanks for the paint circulating systems are housed in a separate room and reach the booths by a piping network which allows continual recirculation. At the present time only three circulating systems are needed since only one color is used in large quantities. One system is for the prime paint (with two "take offs" available), another system is for the first coat vinyl (with six "take-offs") and the final system is for the second coat vinyl (with six "take-offs"). Each system has two 120 gallon tanks, equipped with air operated agitators. Both tanks are connected to a vertical air driven reciprocating pump, used for circulation, and valved so either tank can be used for mixing or circulating. Each circulation line is provided with a filter, regulator and surge tank as well as fluid pressure regulators at each takeoff station. The room is of adequate size so additional circulation systems can be installed if required.

Next to the paint mix and circulation room is the paint storage room. This room has racks with a capacity of 144-55 gallon drums. In addition, area is provided for low usage paints which are stored in 5 gallon drums and which are sprayed from pressure pots.

Additional equipment for improving the paint shop efficiency include: a paint stripping line for removal of paint from rejected parts (the old paint unit had no stripping equipment, requiring transfer of parts to other areas), a 12-foot spray booth for painting special finishes in small lots and a batch oven to provide baking facilities for the special parts.

The new paint shop has been in full operation with the new vinyl paint since August 1957 and, even though all the storage areas are not yet available, estimates and expectations have been realized in improved flow, increased capacity and reduced costs.

CHEMICAL POLISHING

By Lester F. Spencer,

Finishing Engineer, West Allis 19, Wis.

This is the second and concluding part of the article on Chemical Polishing. Part I appeared in the March issue.—*Ed.*

Aluminum and Aluminum Base Alloys

The use of chemical polishing procedures for aluminum and some of its alloys has found favor as a finishing treatment and, in many instances, it has replaced electrolytic polishing particularly as a pretreatment for decorative anodizing. The majority of the solutions commercially available contain phosphoric acid as the basic ingredient to which nitric, sulfuric, and/or acetic acid is added. Although phosphoric acid itself will polish aluminum at 80°C. (175°F.), and the phosphoric-sulfuric acid combination is claimed to be the least expensive, the best results are obtained by the use of the nitric acid-containing solutions. This fact undoubtedly led to the acceptance of the three major processes under consideraion, — the phosphoric-nitric, the phosphoric-nitric-acetic, and the phosphoric-sulfuric-nitric acid mixtures.

The aqueous solution of the phosphoric-nitric acid combination[14] is stated to give a total reflectivity in white light of 87% on commercial aluminum, while reflectometer readings gave slightly lower values for the aluminum-manganese (3003) and the aluminum-magnesium (5052) alloys. The bath is operated at about 90°C. (194°F.) with immersion time varying from ¼ to 5 min., depending upon the initial surface condition. A typical formula consists of:

Phosphoric acid	80.5% (by vol.)
Nitric acid	3.5%
Water	16.0%

In the formulation of the phosphoric-nitric-acetic acid mixture, it had been found that acetic acid may be added in quantities up to ⅓ by weight of the total of the other constituents; a typical solution containing 70% phosphoric acid (by wt.), 2.0% nitric acid, 15.0% acetic acid and the balance water. Meyer and Brown[15] also worked on a similar solution; the composition and operation conditions being given as:—

Phosphoric acid	70.0% (by vol.)
Nitric acid	3.0%
Glacial acetic acid	12.0%
Water	15.0%
Temperature	212 to 248°F.
Immersion time	2 to 6 min.

In the use of the above bath, it is stated[1,15] that, due to the high temperature of operation, the use of adequate fume extraction facilities is essential, thermostatic temperature control is necessary and the solution should be agitated during operation; mechanical agitation being recommended. Although the life of the solution is short in that the finish deteriorated when

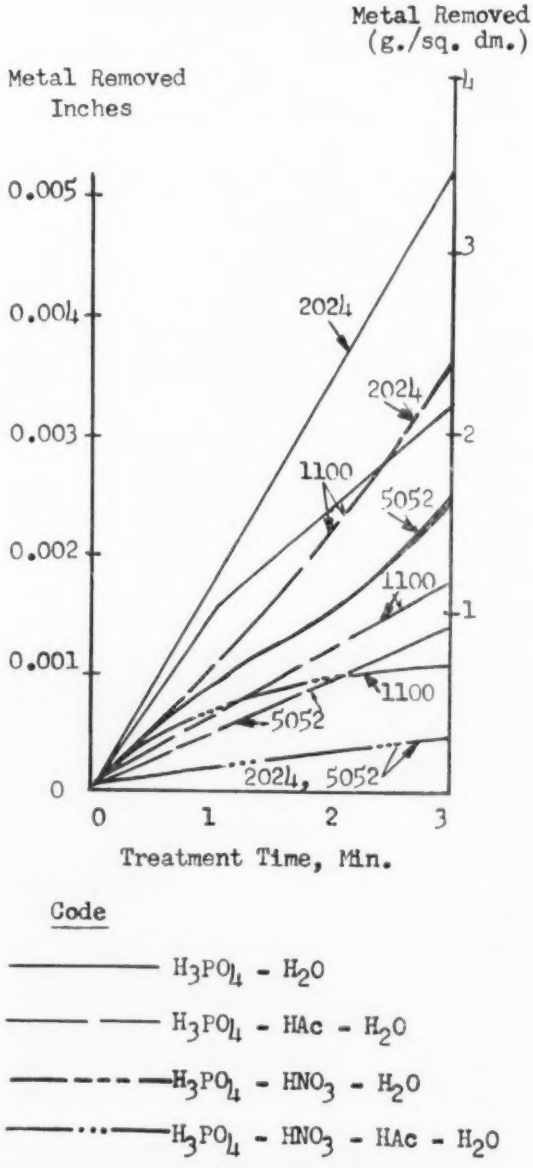


Figure 4. Dissolution of aluminum (1100-H14) and the aluminum alloys designation 5052-H14 and 2024-T3 in various chemical polishing solutions. Temp. 120°C. (250°F.) Mild agitation.

TABLE II

Chemical Polishing Solutions for Aluminum:—Typical Compositions in parts by Vol. and Operating Temperatures

Type	Phosphoric Acid (d. 1.71)	Sulfuric Acid (d. 1.84)	Nitric Acid (d. 1.50)	Temperature Deg. C.	Temperature Deg. C.
A	300	600	70-100	115-120	240-250
A	400	500	60-100	100-120	212-250
A	500	400	60-100	95-115	203-240
A	600	300	50-80	95-115	203-240
B	700	250	30-80	85-110	185-230
B	800	100	30-80	85-110	185-230
B	900	50	30-80	85-105	185-221

the solution contained 20 to 30 g./l. aluminum, the solution is maintained by the addition of nitric acid and water. According to Meyer and Brown, the drag-out experienced in actual practice often balances this increase in the aluminum content of the solution; with the result that the solution is rarely discarded. In a study of the dissolution rates of this solution, the authors compared the phophoric-nitric-acetic-water mixture to the phosphoric-water, the phosphoric-acetic-water, and, the phosphoric-nitric-water mixtures. Although the rate of reaction was faster in those solutions containing no nitric acid, the finish was slightly inferior. This study is given in Fig. 4. The total amount of metal removed to obtain an optimum finish in the bath under discussion is stated to be approximately 0.0002 to 0.001 inch.

The concentration of the acids in the phosphoric-nitric-acetic acid mixture is considered not too critical, with the net result that many different solutions of this type are in use. The water is also considered as non-essential, since good results may be obtained in the absence of water at an operating temperature of 85 to 95°C. (185 to 195°F.).

As illustrated in Table II, a wide range of both sulfuric and phosphoric acid content is permitted in the phosphoric-sulfuric-nitric acid mixtures. The high sulfuric acid content solutions, designated as Type A in the table, are reputed to smooth coarse surfaces rapidly [1,16,17]; however, they are suitable only for aluminum of a purity in excess of 99.5%. Solutions of Type B are stated to be satisfactory for the brightening of commercial aluminum as well as the aluminum-magnesium-zinc and the aluminum-copper-magnesium alloys where the alloys do not exceed 8% zinc and 5% copper respectively. This finishing treatment is usually performed after mechanical polishing.

In order to increase the rate of attack and allow the use of both a lower operating temperature and higher water contents, nickel and cobalt and, to a lesser extent, zinc and chromium salts are sometimes added. A solution of this type[18] contains 50% phosphoric acid, 6.5% nitric acid, 6% acetic acid, 25% sulfuric acid, 12.5% water and 3 g./l. crystalline nickel nitrate. This solution polishes in 3 min. at 90°C. (195°F.).

A typical solution recommended for alloys containing more than 1% silicon, which normally do not polish well, is made up of 70% phosphoric acid, 25% sulfuric acid, 5% nitric acid and 3 g./l. crystalline nickel sulfate. This solution operates between 95 and 115°C. (200-240°F.); the immersion time is 6 minutes, and the rate of metal removal is at 0.00004" per minute. Other catalytic additions include 3 g./l. sodium nitrate[19] and various inorganic acids[20] such as boric, vanadic, molybdic, or tungstic acid.

There are other solution types that have been developed for the chemical polishing of aluminum which can be given at this time. A typical alkaline type bath consists[21] of sodium nitrate 300 to 500 grams, sodium nitrite 200 to 300 grams, sodium hydroxide between 300 and 600 grams, sodium phosphate 100 to 300 grams and water 100 to 300 cc. Another patented bath designed for the polishing of aluminum containing not more than 5% silicon[22] consists of an aqueous solution containing 0.5 to 30 grams sodium nitrate and 0.25 and 10.0 grams sodium sulfate dissolved in 100 cc. phosphoric acid, the operating temperature of this bath being from 150 to 275°F. Another patented mixture[23] for the chemical polishing of aluminum is stated to consist of phosphoric acid, hydrogen peroxide and from 1 to 3% graphitic carbon. Hydrogen peroxide has been recently added to the phosphoric-nitric acid solutions used for the polishing of aluminum. Pinner mentions one such method that was introduced by Klein[20] that can polish 35 sq. ft. per liter of phosphoric acid (d. 1.70) with the addition (including maintenance) of 250 cc. of hydrogen peroxide (100 vol.) and 1.3 liters of nitric acid (d. 1.25).

The main industrial application for chemical polished aluminum is as a pretreatment for decorative anodizing. Two types of finish may be obtained:— (a) a highly polished mirror type finish obtained by the slower acting solutions containing in excess of about 70% phosphoric acid, which is usually suitable for surfaces that previously have been mechanical polished; and, (b) a bright finish with usually lower specular reflectivity than that exhibited in mechanically polished surfaces which, however, is satisfactory for the production of bright anodized and dyed work. In this case, the faster acting solutions, containing from 40 to 65% phosphoric acid, may be used. When used in a continuous chemical polishing — anodizing sequence, Meyer and Brown[15] found that shorter anodizing times are required to obtain the same film thickness; this be-

ing associated with the greater diffuse reflectivity of the chemically polished surfaces. In addition, Meyer and Brown also reported stronger colors after dyeing.

Iron and Steel

The degree of brightness obtained on steel will depend both upon the carbon content and the alloying constituents within the analysis. A solution that will provide both a brightening and smoothening action proposed by Marshall[24], is composed of 2.5% oxalic acid, 1.3% of 30% hydrogen peroxide and from 0.007 to 0.010% sulfuric acid. The operating temperature is 65°F. while the metal dissolution rate, which is quite slow, is 0.0004 inches per hour on mild steel. It has been reported[6] that dissolution rates can be increased to 0.0008 in./hr. by agitation and to about 0.001 in./hr. by increasing the operating temperature to about 105°F. The bath removes grinding scratches in about 30 minutes. It reduces the micro-inch finish from 39 to 21 and from 19 to 12 in about 90 minutes.

Pinner mentions two major difficulties experienced with this solution namely:— (a) the instability of hydrogen peroxide in the presence of dissolved iron, and (b) the decomposition of oxalic acid by hydrogen peroxide even in the absence of iron. A surface film remains after chemical polishing. This film, which is on the order of 60Å, will give a certain degree of corrosion resistance under mild exposure conditions. Since it is soluble in dilute acids, approximately 3.0 to 3.5 pH it, therefore, does not interfere with the adhesion of nickel deposits from low pH baths.

In an analysis of the Marshall process in regards to possible application, it appears that the smoothening action is sufficiently good as a substitute for mechanical polishing used as a pretreatment for dull nickel plating. However, Marshall claims that the surface is not sufficiently smooth for bright nickel plating. Good results have been achieved by bright zinc plating on chemically smoothed steel. Another possibility as a semi-bright surface to improve corrosion resistance does not seem too promising, either as a passivation treatment for mechanically finished surfaces or to improve the adhesion of electrodeposits without considerable loss of specular reflectivity.

A solution containing 30% by wt. hydrochloric acid, 40% sulfuric acid, 5.5% titanium tetrachloride and the balance water has been patented by Uhlig[25] and has been found to have considerable smoothening action in the polishing of the austenitic stainless steels. The solution is operated at a temperature of 148° to 176°F. with an immersion time of from 2 to 5 minutes, during which about 0.00044" of metal is removed. The resultant polished surface can be passivated by the usual nitric acid solution; however, the same result may be achieved by adding 0.5% nitric acid to the polishing solution. It is stated that the titanium tetrachloride appears to be the agent responsible for the smoothening action and, on the basis of a reduction in hydrogen evolution, Uhlig suggested that its function is to take up hydrogen displaced by the acids.

Another solution suggested[27] for the polishing of the austenitic stainless steel consists of 2.5% nitric acid (sp. gr. 1.42), 7.5% hydrochloric acid (sp. gr. 1.16) and 1% inhibitor, all by volume. Hayes and Lomakin[26] have revealed a solution that will polish austenitic stainless steels where the chromium content will be from 10 to 35%. This bath consists of, by volume, from 2 to 8% nitric acid, 4 to 15% hydrochloric acid, 2 to 12% hydrofluoric acid, 3 to 18% sulfuric acid, and the remainder substantially water with at least one organic compound of the alkaloid class amounting to about 0.05 to 6% by weight of the bath.

Chemical Polishing of Other Materials

The more common solutions used for both bright dipping and chemical polishing of zinc and cadmium would include the dilute acids, the chromates and dichromates, and the hydrogen peroxide solutions. Within the first category, the dilute acids would include nitric, hydrochloric, and oxalic acids, all of which are relatively inexpensive and suitable for the bright dipping of both castings and plated work. The dilute nitric acid, which is an aqueous solution containing from 0.3 to 1.0% by volume nitric acid,[6] is a popular type that is operated at room temperature.

Both dilute chromate and dichromate solutions have also been used for brightening. The chromic acid-sulfuric acid mixture is reputed [28,29,30] to produce a micro smoothness; typical solution types being[6,31]:

	Chromic Acid	*Sulfuric Acid*
Zinc plate	300 g./l.	5 g./l.
Racked cadmium plate	100 " "	1.67 " "
Cadmium plate (barrel)	100 " "	1.0 " "

These solutions are operated at room temperature; the time of immersion varying from 5 to 10 seconds when the treatment is one of passivation to produce an iridescent film. This film is usually green in color on zinc and yellow on cadmium, a minimum of metal dissolution taking place. Micro-polishing action may be obtained when the ratio of chromic acid to the sulfate content is controlled. Thus, Soderberg and Dubpernell[28,29,30] have stated that a ratio of 40:1 gives the best results. When this ratio drops below about 20:1 a brown film is formed. In addition, a similar film is formed when the concentration of trivalent chromium produced by the reaction exceeds 10 g./l. When they occur, they may be removed by dipping the work either in weak acids[6] where the pH is greater than 2.5, or, in caustic solutions that are greater than 4 N.

The more common addition agents for the chromic-sulfuric acid solutions are the alkali metal salts such as sodium dichromate, sodium sulfate, etc. One such solution[30] consists of from 10 to 60 oz./gal. chromic acid, 0.1 to 1.0 oz./gal. nitric acid and 0.05 to 5.0 oz./gal. sodium sulfate. Where this process is part of a bright plating sequence, Pinner cautions that the electrodeposits should be of sufficient thickness to stand the removal of 0.0001 to 0.0002 in. This may present some difficulties on components with deeply recessed parts where special attention is often required to maintain the optimum throwing power of the plating solution.

The hydrogen peroxide solution, patented by Hull,[33] consists of 3 to 4.5% by weight hydrogen peroxide

(30%). 0.3 to 0.5% sulfuric acid (sp. gr. 1.84) and the balance water. This solution is applicable for polishing cadmium deposits and is operated at room temperature, realizing a dissolution of about 0.00005"/min. The usual immersion period is about 15 seconds. When a solution such as this is used for zinc, the analysis is modified slightly to about 4% hydrogen peroxide and 0.25% sulfuric acid. The pH of this solution is kept between 1.0 and 2.5 with the optimum ratio of hyrogen peroxide to acid at 16:1.

In order to avoid contamination, especially where the zinc or cadmium has been deposited in an alkaline bath, the bright dip is preceded by a dip in a weak acid, such as 1% sulfuric acid, rinsed and then immersed in the polishing solution. It has been stated that other mineral acids such as acetic, hydrochloric, or lactic acid may be used as a replacement for sulfuric acid in the brightening solution.

Monel and nickel are the more important metals that utilize chemical polishing procedures. The phosphoric-nitric-acetic acid mixtures, previously mentioned in the chemical polishing of the copper base alloys, containing small additions of sulfuric and hydrochloric acid will brighten and smoothen these metals. Warner[39] has mentioned the sulfuric-phosphoric-nitric acid solution that is applicable in brightening nickel; a typical solution consisting of 60% phosphoric acid (sp. gr. 1.70), 20% sulfuric acid (sp. gr. 1.84), and 20% nitric acid (sp. gr. 1.42), all by volume. Immersion times will vary from 1 to 3 minutes which, at an operating temperature of 180°F., will realize metal removal from 0.0001 to 0.0003 inch per minute. Dull nickel plate, such as Watts, cannot be made bright[6] by chemical polishing under practical conditions; however, semi-bright and off luster bright nickel plate can be made uniformily bright. Pinner has mentioned the successful use of an aqueous phosphoric-nitric-sulfuric acid mixture with the addition of alkali metal salts.

In the polishing of silver, Parker[34] described an aqueous sodium cyanide-hydrogen peroxide bath. The solution contained 1.5% sodium cyanide and 8.5% of 30% hydrogen peroxide. The bath should be mixed at 80°F. and used below 90°F. When gassing starts, the silver is removed and dipped in a solution containing 37.5 g./l. sodium cyanide. This procedure is repeated until the desired brightness is obtained. Since the hydrogen peroxide is unstable in the presence of dissolved silver, it is recommended that a fresh solution be made each time.

Soderberg[31] has suggested a solution containing 3.5% hydrogen peroxide (30%) and 3.5% glacial acetic acid for the brightening of lead. This solution causes a periodic brightening and darkening of the lead. This may serve as a basis[6] for a bright dip with a somewhat lower acid content.

Beryllium may be chemically smoothened and brightened[35] in a solution containing 5% by volume sulfuric acid (sp. gr. 1.84), 75% phosphoric acid by volume (sp. gr. 1.70), 7% by weight flake chromic acid and the balance water. Machined beryllium surfaces are given the standard degreasing and cathodic alkaline cleaning after which they are dipped in the polishing bath operating at 120°F. The dissolution rate is

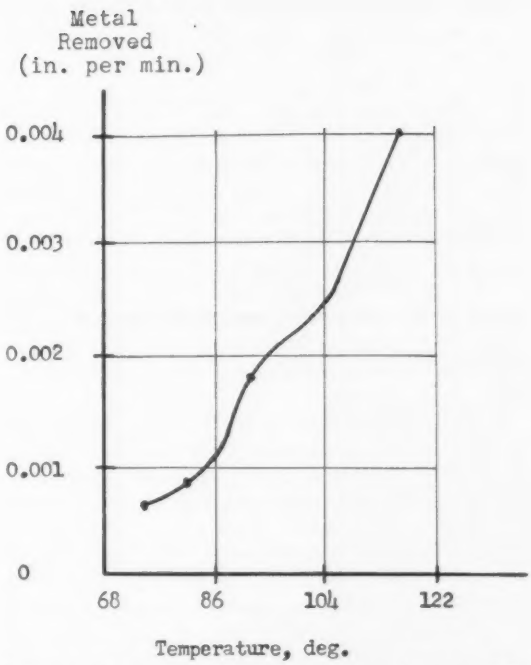


Figure 5. Metal removal versus temperature in chemical polishing of zirconium in ammonium acid fluoride-nitric acid-fluosilicic acid solution.

rather slow with approximately 0.00005 inches of metal dissolving for each minute of exposure. The semi-passive film that is formed during the polishing operation, which is believed to be either an oxide or chromate film, can be removed by immersion of the part in 6% by weight sulfuric acid for ½ to 1 minute.

Another specialized solution is that used for the brightening of zirconium. This solution, which also produces a fairly smooth surface, contains 100 g./l. ammonium bifluoride, 400 ml./l. nitric acid (sp. gr. 1.42), 200 ml./l. fluosilicic acid (30 to 31%) and the balance water.[36] At an operating temperature between 70 and 80°F., this dip removes about 0.0006 inch of metal per minute. When the operating temperature is increased to 90 and 95°F., the rate of dissolution is also increased to a value of 0.0018 in./min. Fig. 5, which is adapted from data of Schicker, Beach and Faust,[36] illustrates the dependency of metal removal on temperature.

Beach, in a recent patent, revealed a process of polishing the surface of zirconium metal containing zirconium carbide occlusions; the solution consisting of an aqueous solution containing at least 50 grams of a water soluble fluoride, 350 to 600 cc. of concentrated nitric acid and from 175 to 400 cc. of 30% fluosilicic acid. The operating temperature is stated to be between 60 and 85°F.

Applications of Chemical Polishing

Chemical polishing is still relatively too new to have permitted discovery of all its potential uses; however, it promises to be an exceptional tool in the finishing field; as with any other processes, chemical polishing has a number of attractive advantages for the potential user, but it should also be realized that the processes thus far considered have inherent disadvantages.

In a discussion of the Battelle process, Deubner[4] has cited several examples where chemical polishing has been used commercially with success. In the case of luggage lock manufacturing, the process has eliminated[5] buffing operations in the finishing of locks and hasps, realizing a savings of about $65 per 1000. Other applications mentioned included the polishing of picture frames as a pretreatment for subsequent nickel and gold plating; the chemical polishing of such items as brass pocket flashlight cases, brass screws, brass compacts, safety pins, nickel laundry tags, nickel- silver clips used in the dental industry, spun shapes and tubing made from Monel, pencil ferrules and brass license plate frames, and as a pretreatment for the preparation of brass assemblies for copper and nickel plating.

Brass rings, which are normally bright dipped and tumbled prior to receiving a gold flash plate, can be chemically polished[4] in bulk in a basket to obtain a satisfactory finish in 90 seconds. Brass fireplace screen frames, also mentioned by Deubner, may be given a 2 minute treatment after which they can be color-buffed to a mirror-plane surface, this treatment eliminating all other wheel polishing operations normally used. In the use of a chemical polishing treatment on large objects, such as bumper guards for automobiles, Deubner has cautioned that the copper plate should be of sufficient thickness so that the polishing operation will not cut through to the steel. In the polishing of appliances with a copper undercoat, the normal 0.0003 to 0.0005 plate thickness is sufficient for chemical polishing provided that the copper plate is fine grained.

In regard to the use of chemical polishing as a pretreatment for anodizing aluminum in the successful application for automotive trim, Pinner has given the limitations and advantages of chemical polishing. The limitations include:— (a) the process can be used only on wrought aluminum and its alloys; (b) for optimum results, polishing solutions for aluminum can be used only on high purity aluminum and on the high purity aluminum-magnesium alloy which limits the range of properties available to designers; and, (c) although certain types of chemical processes can be used to give a good bright finish on commercial quality aluminum and several of its wrought alloys, high purity material is required to obtain a finish equivalent to high quality chromium plate.

The advantages cited included:— (a) the corrosion resistance of chemically polished aluminum is higher than a nickel-chromium finish, not only to corrosion of the basis metal which is a function of the thickness of the nickel deposit but, also, to pitting corrosion on the chromium deposit which cannot be overcome by increasing deposit thickness; and, (b) the cost of chemical polishing is low.

The chemical polishing process has also been used with success in the preparation of metallographic specimens which require a surface that is free from distortion and amorphous layers. Herenguel,[17] in the use of this process for aluminum alloys, has stated that clearer images are often obtained by chemical polishing than by electrolytic methods, this being particularly true on multi-phase alloys. A solution that he describes contains:

Phosphoric acid	90% by volume	(d. 1.71)
Nitric acid	10% "	(d. 1.50)

The immersion time is 30 seconds at 85°C. (185°F.) and it has been used for both polishing and etching the aluminum-magnesium, aluminum-magnesium-silicon, aluminum-zinc-magnesium and the aluminum-copper-magnesium alloys. A solution containing 70% phosphoric acid, 25% sulfuric acid and 5% nitric acid was used by the same author on multiphase alloy type which revealed intermetallic compounds and variations in the composition of the primary phase.

Pinner has mentioned the use of chemical polishing for superfinishing and electrofinishing operations on difficult shapes; this being one of the successful applications for the electropolishing process. This same author has done preliminary work on brasses, phosphor-bronzes and other copper alloys and had concluded that his solution type[12] was suitable. By this process, it was claimed that dissolution was comparatively slow, uniform, and easily controlled; an accuracy of 0.00005" being obtained without difficulty provided a thermostat was used. Due to the absence of current, throwing power problems are absent and areas that are not to be reduced may be masked by a plastic stop-off. Since the rate of reaction diminishes as the metal concentration in the solution builds up, it is necessary to check the rate of metal removal periodically. It is further stated that the bath under discussion (aqueuos solution of phosphoric-nitric-hydrochloric acid and hydrogen peroxide) is maintained by nitric acid and water additions up to a total metal con tent of upwards of 30%.

Conclusion

There are many variables that must be considered when estimating the cost of chemical polishing, which would include the type of solution selected; the type of metal to be polished along with its original surface finish; the shape, size, and design of the part to be polished; and the temperature of operation of the bath. A brief consideration may be made of a number of these variables,[1] thus:

Surface Area — In chemical polishing, the cost of solution will depend upon the metal carrying capacity of the solution before it must be discarded. In addition, the possibility of regeneration of the solution must be considered. The above is related to surface area and, when compared to mechanical polishinig, it is generally conceded that the larger the surface area, the more economical is a mechanical polishing procedure.

Shape — This factor affects costs in chemical polishing insofar as it determines whether bulk treatment is permissible. With the exception of parts that are wired or racked, as when chemical polishing is an operation within a plating sequence, components that nest together cannot be treated in baskets. Also, deeply recessed parts may cause excessive drag-out losses especially when the more viscous polishing solutions are used. These difficulties are also pre-

sent in electropolishing which, in addition, may have throwing power difficulties.

Initial Surface Condition — Both the initial texture and the presence of defects on the surface of a part will affect the costs of both chemical and electropolishing procedures in that it determines the immersion time. The previously mentioned pretreatment by barrel polishing may be advisable to improve the surface. In chemical polishing, this factor is also related to both the rate of reaction and the smoothening efficiency of the selected solution. This same factor will determine the number and type of mechanical polishing operations.

Operation Sequence — When chemical polishing is within a sequence for either electroplating or anodizing, the labor costs for racking may be ignored. Where the item is polished for subsequent application of a lacquer, the labor costs for polishing and bright dipping are similar. Mechanical polishing costs usually are not affected by operational sequence.

In considering the over-all costs involved in chemical polishing, it has been stated[6] that practical operations will involve a cost ranging from 0.1 to 1.0 cent per square foot, the lower figure usually applying to bright dipping while the higher value represents chemical polishing costs. When the limitations of chemical polishing are properly considered, in regard to alloy and finish limitations, chemical polishing will provide a savings in costs. It should be remembered that chemical polishing is not suitable for large, flat surfaces where an undistorted mirror image is required. It is, however, particularly suitable for rounded surfaces, e.g., convex shapes or broken surfaces.

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FINISHING POINTERS

(*Continued from page* 58)

same hard heat-treated metals are required whether or not the part is plated.

Excessive dirt or hard particles on a heavy working surface will crush through a chromium deposit into the basis metal. The chromium thickness should be greater than the thickness of the abrasive particles that cause the wear. Where it is difficult to keep equipment clean, heavy chromium should be used. However, it is not to be expected that chromium plating is a substitute for cleanliness. Chromium does wear. It is only successful because it is much more wear resistant than other hard metal surfaces, such as the heat treated tool steels.

Chromium is used for a good surface impression, such as printing plates. Here excessively thick deposits will cause a loss in sharpness of the impression. Thicknesses of 0.2 to 0.5 mils are used for long runs to extend the life of plates without loss of sharpness of the impression.

Finally, it is well to mention that very smooth chromium does not retain oil well. For most applications this is not a factor. Ground surfaces retail oil better than as-plated smooth surfaces. In some instances, where oil retention is a factor, porous chromium deposits have given much longer life than smooth deposits.[2]

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Science for Electroplaters

35. Ion Exchange Properties

By L. Serota

Structure

DEVELOPMENT of ion exchange processes has been enhanced by the relatively recent and extensive studies of the characteristics or properties of exchangers. Foremost in the improvements effected is the increase in exchange capacity and stability of synthesized resinous exchangers. The principal active (polar) groups in cation exchangers are the sulfonic —SO_3H; methylene sulfonic, —CH_2SO_3H; carboxylic, —COOH; and phenolic, —OH. The exchangeable or positive hydrogen ion in these groups is called the "counter ion" and is attached to and balanced by a polyvalent (negative) anion consisting of a high polymeric cross-linked structure. The exchangeable insoluble resin consists then of a simple diffusable cation and a large non-diffusible anion.

The acid strength or degree of ionization of such cationic exchangers may be indicated by the titration curves in Fig. 155. Curves D and E represent the neutralization of the sulfonic acid group and are characteristic of strong acids; and curve B, representing the neutralization of the methylene sulfonic acid group, also exhibits strong acid properties. Exchange capacity for metallic cations of resins

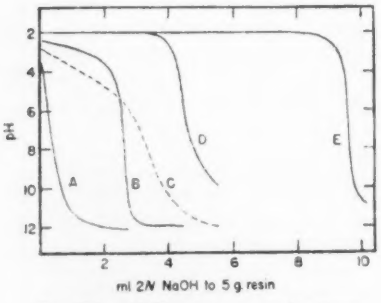

Fig. 155. pH-Titration curves of resinous exchangers.
Resin A: Active group, phenolic —OH
B: Active group, —CH_2SO_3H
C: Active group, —COOH
D and E: Active group, nuclear —SO_3H

containing these active groups only is not affected by changes in the pH of the solution. The exchange capacity of weak acids is affected by changes in pH. Curve C for the carboxylic group, displays the pattern of a weak acid similar to that obtained in the titration of low molecular weight acids containing carboxylic groups. The curve for the phenolic group (A) is not complete, since ionization to any degree does not begin below a pH of 9.5 The curves clearly indicate that the sulfonic acid group displays the properties of the strongest acid, and the phenolic group in the cation exchange resins the weakest strength of the three acids.

According to *R. Kunin* and *R. J. Meyers*, these titration curves show that the (neutralization) reaction is a combination of two reactions, namely $HR + M^+ \rightarrow MR + H^+$ and $H^+ + OH^- \rightarrow H_2O$. The letter R represents the large anion in the resin and M^+ a monovalent metal cation. Further evidence of the acid property of cation exchanger, in the hydrogen form is indicated by *O. Samuelson*, who found that such resins reacted with zinc powder, calcium carbonate, and zinc sulfide, liberating respectively hydrogen, carbon dioxide, and hydrogen sulfide.

Anion Exchangers

As with cation exchangers, the cross linked network in the resin structure is essential for physical and chemical stability in anion exchange resins. Such resins are essentially polyvalent cations obtained from polymerization of both monomeric amines and negative counter ions, or (high molecular weight) insoluble bases, or the corresponding salts. The active groups are the primary, secondary, or tertiary amino groups, —NH_2, —NHR, —NR_2, which impart weak or medium basic strength characteristics to the anion exchange resin.

The quaternary ammonium groups, —NR_3^+, are introduced for the strong base type. The basic characteristics as well as exchange capacity of these anion exchangers, when neutralized in a 1.0 N KCl solution, are shown in the titration curve, Fig. 156. Type I represents the alkyl amine and Type II the curve, for the alkanol amine, both strongly basic or quaternary amines. *R. Kunin* and *F. X. McGarvey* have reported that the recent introduction of the strong base (quaternary) type of anion exchanger has extended the use of such resins to neutral and alkaline media, whereas, the weak base type exchangers were limited to acid media.

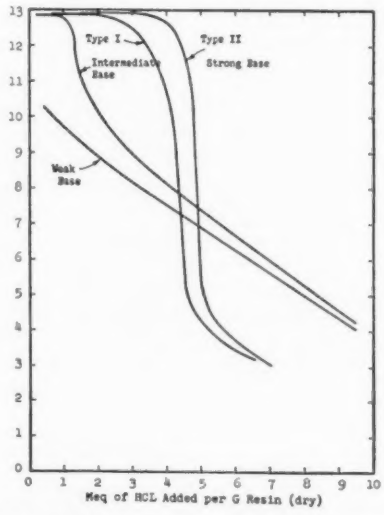

Fig. 156. Titration curve of anion exchangers on 1.0N potassium chloride indicates capacities for exchange at various pH levels. Various phenomena, however, prevent use of these curves for evaluating ion exchangers for commercial work.

Insolubility and Swelling

An essential physical requirement for an anion exchange resin is its insolubility in such common solvents as water, alcohol, and glycol. The ion active groups, like the sulfonic acid or quaternary amine type, when attached to linear polymers will dissociate and become soluble in water. Such polymers, in which the carboxylic group is present, dissociate and become soluble in alkaline media, whereas, the primary, secondary, or tertiary amino groups will dissociate in acid media. To attain insolubility, the ion active groups in the resin are attached to a cross-linked skeleton in the polymerization process, producing a complex molecular network.

Because of the chemical instability, with alkaline oxidizing agents, of phenol-formaldehyde type resins, or the instability to strong acids of urea-formaldehyde resins, the field for ion exchange resins is reduced, according to *W. C. Bauman* in the text "Ion Exchange," to two types of chain formers, namely the straight hydrocarbon —C—C—C—C— and the amine link —C—N—C—N—. For example, in considering the fundamental properties of a synthetic cation exchange resin, a styrene polymer, in which the nuclear sulfonic acid group was the only ion active group, Bauman reported that, since this resin will react at any pH, and since its type of hydrocarbon skeleton is stable to strong acids, alkalies, oxidizing agents, and heat, it is possible to study the exchange properties of the sulfonic acid group over a greater range of conditions than was possible with sulfonated phenol-formaldehyde resins.

Solubility of exchange resins is associated with the phenomen of swelling. The degree of swelling in a solvent is related to the number of cross-linkages or the closeness of the network in the polymer. Some resin exchangers may swell in water to a volume of 100 ml. per gram of dry resin; or, expressed otherwise, a resin structure containing one crosslink for one hundred atoms in the chain may swell possibly ten times its volume from the dry to the wet stage, whereas, with one cross-link arrangement for ten atoms in the skeleton the resin structure may swell only twenty per cent of its dry volume. Chemical stability, however, remains satisfactory by this process.

Although, the exchange capacity of a resin is increased with the addition of more active groups in the network, the number of cross-linkages in such structure governs the degree of swelling, with the maximum results gained by the presence of frequent cross-links and a high concentration of active groups on the chain. Increase in electrolyte concentrate causes decrease in swelling. This consideration is important since, although increases in such structure or tightening of the network will tend to increase the exchange capacity, the diffusion rate of ions will be decreased, resulting in a lower rate of exchange. One effect would be the possible formation of channels in the exchange column. If the skeleton structure is open, swelling may be excessive so that, for practical purposes, a denser network is preferable. Swelling will depend upon the particular process cycle as, for instance, a reduced speed in water softening with concentration of only 3 grains of calcium carbonate per gallon.

It is also possible to separate large and small ions by regulating such spaces or pores. If, for example, the pores in the skeleton are smaller than the size of a large ion in solution, then penetration of the network by the ion is not possible; whereas, the smaller ion which does penetrate the structure can be separated, a process that is applicable to the separation of low and high molecular weight acids with anion exchange resins. Regulation or varying of the number of cross-links in the structure, therefore, is an effective means of controlling the openings or pore spaces, thus providing a method for the separation of ions of different dimensions. A denser network and reduced swelling may be attained by increasing the amount of divinylbenzene. Sulfonation of such polymers gives cation exchangers with different swelling proportions.

Swelling also occurs with the sulfonated coals and some types of clays, such as montmorillonite types, a magnesium aluminate silicate. *H. F. Walton*, referring to the effect of swelling on the cation selective properties of exchange resins, noted that the degree of absorption of different cations is reduced as the swelling of a resin in water increases. When such an exchange resin is in contact with water, the water will diffuse and swelling will depend upon the extent of the cross-linked network. The hydrogen ion from the surface sulfonic acid group will diffuse into the water phase, with the negatively charged $—SO_3^-$ radicals remaining. The result will be an electrical double-layer at the surface. The resin side thus carries a negative charge and the water side a positive charge.

To repeat, then, substitution of basic groups in such polymeric structures with different amounts of cross-linkage will produce anion exchange resins with varying degrees of swelling. An increase in the number of cross-links will result in a decrease in swelling.

The swelling of anion resins is shown diagrammatically in Fig. 157. The majority of hydroxyl ions in this diagram are attached to the amine skeleton network (the wave-like lines) since the figure represents a resin of the weak base type which is but slightly ionized or dissociated.

Fig. 157. Basic structure of anion exchange resin.

Swelling in water, because of the slightly ionized character of the basic resin, will not be appreciable, but it will be more for the salt form because, in that state, it is completely ionized. The weaker electrical-double layer at the surface of anion resins, due to the weak base character compared to the sulfonic acid cation exchange, will result in limited migration of the OH^- ion from the resin surface to the solution. The presence of hydroxyl ions in the double layer can be shown, as the pH is increased, by using a glass electrode.

Ion Exchange Equilibria

"Equilibria" refers to the distribution of cation (or anion) between the resin or solid exchanger and the electrolyte in solution. For example, an ion exchanger may be mixed or shaken with a solution containing a specific ion. In time, either minutes or days depending upon the exchanger (as determined by analysis), exchange of ions will take place and equilibrium will be attained. At this stage the concentration of the ions in the solution will have changed; ions which were previously attached to the exchanger will be found in the solution, and ions from the solution will be found in the exchanger but at different concentrations from that in solution. This shaking process, which is comparable to batch operations, will not yield quantitative adsorption. Column operation or percolation is necessary for such results.

F. W. Walton noted that, with synthetic resins or aluminum silicate ion exchangers, because of the gel structure, ion exchange will occur within the granules, thus simplifying the

separation of solution and soild for analysis. With clays and soils as ion exchangers, because of the compactness and small size of the solid particles, giving a large outer surface, ion exchange will take place mainly on the surface. The exchange of cations is thus held as a diffuse double-layer. The boundary between the solution and exchanger will not be as distinct, therefore, as with synthetic resins.

O. Samuelson reported on experiments on ion exchange equilibria, using a sulfonic acid (polystyrene) resin containing a low ion concentration in the resin phase, between hydrogen ions and monovalent cations such as Na^+, K^+, NH_4^+. Results showed diffusion of these cations into the resin phase, and the proportionate amount of hydrogen ions to meet electrical neutrality requirement leaving the exchanger, a condition which the author noted was in agreement with the Donnan theory.

Divalent ions did not yield favorable results, a fact which Samuelson attributed to the activity coefficients of these ions in the resin phase, as well as to the effects of these ions on swelling of the ion exchanger — compared to no swelling in the hydrogen ion-monovalent cation exchange. Swelling is less for the ion that is most strongly held. For the common highly cross-linked ion exchangers, in which the ion concentration is from three to seven normal, the author expressed the view that the activity coefficient in the resin phase must be considered for the Donnan equilibrium equation.

Cation exchange will always take place on an equivalent basis; that is, for each gram equivalent weight of cations adsorbed by the exchanger, a gram equivalent weight of cations must be given up.

Ion Exchange Knetics

Exchange equilibrium is governed by a number of factors. The rate of ion exchange may be rapid and not appreciable affected by temperature, so that equilibrium in some cases may occur instantaneously (as in the mineral kaolinite, where the exchange site is at the surface of the sheet); or a slow rate may result if ion exchange by the ion active groups, as in the zeolite cation resin chabazite, is accessible through small pores only. The rate of exchange is reduced for tightly cross-linked ions compared to resins containing fewer cross-links.

An important factor considered in the rate of ion exchange is the diffusion rate of ions through the solid. Samuelson expressed the view that ion exchange is an instantaneous reaction, but the rate-determining factor is governed in most cases, by the diffusion rate of the ions through the solid (resin) particle. *G. E. Boyd* and associates listed the following five distinct steps for the exchange process relating to the movement of the ion through the liquid film enveloping the resin particle: (1) diffusion of the ion through the solution to the resin surface, (2) diffusion of such ions through the adsorbent or gel particles, (3) chemical exchange between the ion and the counter ion of the resin, (4) diffusion of the displaced (counter) ion through or out of the resin, (5) continued diffusion of the displaced ion through the solution.

It was indicated that the first and last steps may be eliminated by agitation. By this method a constant concentration at the solid-solution interface may be maintained. Additional factors affecting an increase in the rate of exchange include reduced particle size and increased temperatures. *R. Kunin* and *R. J. Meyers* consider exchange equilibrium a function of the chemical structure of the resin, and the kinetics a function of the physical structure.

A study in the comparative rates of exchange for carboxylic and sulfonic acid cation exchange resins, under similar conditions in respect to particle size and concentration, was reported by *R. Kunin* and *R. E. Barry*, as follows:

Equilibirum	*Equilibrium Attainment time*	*Apparent density g./ml.*
$RCOOH + KOH$	7 days	0.40
$RSO_3H + KOH$	2 min.	0.435
$RCOONa + CaCl_2$	2 min.	0.30
$RSO_3Na + CaCl_2$	2 min.	0.500

Batch Operation

One of the methods used for ion exchange processes is batch operation. The advantage that the procedure provides is in the simplicity of performance. The disadvantage in the use of this method is its inefficiency. The solution to be processed is mixed with a given quantity of ion exchanger and separation is effected by filtration or decanting. The exchange percentage will depend upon the equilibrium of the particular system and, in cases where the reaction does not go to completion, the procedure must be repeated a number of times before complete ion exchange is attained. Mixing a sulfonic acid cation exchanger with salt, for example, because it is a reversible reaction, would require a number of repeated mixes before exhaustion occurs; whereas, the same cation exchanger would yield complete conversion in one mix when treated with caustic soda, since this reaction is not reversible.

Column Operation

A column ion exchanger system is essentially a modification of batch operation, because the solution (of electrolyte) during the percolating process is in contact with a new layer (or batch) of the resinous exchanger. This is especially important, since most exchange operations are concerned with reversible or equilibrium reactions. In this manner, the solution comes in contact repeatedly with fresh portions of the resin, thus providing a satisfactory procedures for complete deionization. A common procedure for complete ion exchange consists of a cation demineralizer followed (in series by an anion bed.

PHOSPHATING TREATMENTS

A COMPREHENSIVE PATENT LITERATURE SURVEY

Introduction

The chemical susceptibility of certain metals to attack by environmental corrosion frequently necessitates the application of a protective barrier upon their surface. The protective barriers are divided into three distinct categories: (1) organic coatings (paint and related materials); (2) metallic coatings applied by electrodeposition, hot dipping, spraying, etc.; and (3) surface conversion, i.e. to convert a portion of the surface into a corrosion resistant, non-reactive layer. Foremost of this third group are those surface conversion treatments that produce coatings containing phosphates.

The modern art of phosphating can be traced to England shortly after the beginning of the twentieth century, when Thomas W. Coslett was issued his patent (British 1906) based upon the use of phosphoric acid for the protection of iron and steel. The use of phosphates as protective coatings predates Coslett by seventeen centuries. Existing evidence indicates that the Romans protected iron articles with phosphates as early as the third century. In the latter half of the nineteenth century a patent was issued in England wherein a steel part was heated to red heat and then subjected to the action of phosphoric acid.

Acid iron phosphate solutions were predominantly used by the early researchers. These simple iron phosphate solutions, however, produced coatings that displayed poor adhesion and afforded a minimum of corrosion resistance. Other metal phosphate solutions were developed later, all of which produced coatings containing phosphate. Control methods were still unreliable, not clearly defined, and not always reproducible by others. Such solutions were not ready for use in the industry due to the fact that procedures were not established pertaining to the required concentrations, the pH values nor contents of the combined and uncombined phosphoric acid. These factors must be known and controlled for successful production. Among the many modifications of metal phosphate solutions found in early patent literature, only zinc and manganese base phosphating solutions have remained in actual use.

Subsequent developments have been principally concerned with speeding up the phosphate formation, thus shortening the processing time. These innovations include the introduction of a metal dihydrogen phosphate in the make-up solution; the addition of accelerating agents such as copper salts, nitrates, nitrites and chlorates; and the use of mechanical pre-treatments of the basis metal to facilitate the initiation of the coating reaction. As a result of these various refinements, the processing time has been gradually decreased from the two and one half hours (approximate) of the original Coslett process to one present day process of one minute (approximate). The time now varies depending on the use of the coating.

Modern phosphate deposits are adherent, and possess only a small amount of residual porosity. These "conversion" coatings are produced by applying, by almost any convenient means (brushing, spraying, dipping, flowing, etc.), suitable solutions to the metal surface to be treated. Phosphate coatings are used today as (1) a base for paint-bonding to iron, zinc, cadmium, aluminum and their alloys; (2) corrosion-proofing of iron, steel and aluminum that is to be left unpainted; (3) to improve the wear resistance of ferrous metal; and (4) to improve in quality and/or economy the cold mechanical deformation of steel (cold drawing, cold extrusion, die stamping, cold forming).

"Successful production of phosphate coating with outstanding rust prevention qualities depends not only upon the accurate control of solution concentration, but in addition, upon the cleaning method, surface preparation and adequacy of rinsing, as well as design method of heating and placement of phosphating equipment. Failure to consider any one of these details of process may nullify the benefits of even the most ideal solution."* An extensive knowledge of detailed design problems can be acquired only by experience. There are, fortunately, a number of reliable firms that have vast experience in both design and material that can be of extensive assistance in successful phosphating production operation.

A large number of the processes widely used today for producing phosphate coatings are covered by patents and are of a proprietary nature. The research chemist and the production engineer are confronted with the problem of selecting or developing a type of phosphate coating that will best serve his immediate need. In order to accomplish this, points of reference are required that will enable him to judge the extent of completeness of proven patents, or as a basis for the development of his own projects. It is with this idea in mind, and the existing need for a systematic compilation of all available patent literature pertaining to phosphating, that this survey has been undertaken.

*Phosphating Treatments — Patent Literature Survey***

1. *Phosphatizing Corroded Iron and Zinc Articles.* **By Galvapol Gesellschaft (Galvanotechnick and Oberflachenchemie). Austrian 168,640. July 10, 1951.**

The phosphatizing agent is applied in thin layers at room temperature to the corroded surfaces without previous pickling or descaling. It consists of a 3:1 mixture of free H_3PO_4 to phosphates. The concentration of metals in the solution is preferably below 15 grams per liter of zinc or 12 grams per liter of Mn, respectively. An after treatment (rinsing, artificial drying) of the phosphatized surface is not necessary.

2. *Corrosion Inhibition of Metals.* **By Karl Petrik. Austrian 173,931. February 10, 1953.**

The metal surface to be protected is first treated with the solution of an alkaline earth-hydroxide. The resulting coating is dried in air to give a pore-filling layer of the respective alkaline earth. The surface so coated is then treated with a 5-25% solution of H_3PO_4 or compounds, containing 1-5% accelerator, e.g. nitrate. A rust-protective primer for subsequent coatings, paints, etc., is so obtained consisting of alkaline earth phosphates and of phosphates of the metal so treated.

3. *Phosphating of Ferrous Metals.* **By Galvapol Gesellschaft (Galvanotechinik and Oberflactenchemie and Willibold Machu). Austrian 183,618. October 25, 1955.**

The articles are treated with dilute solutions of the primary phosphates of Zn, Mn, Cd, Mg etc. acidified with H_3PO_4. Organic accelerators, e.g. picric acid or nitroguanidine are added to the bath continuously or successively to maintain a concentration of approximately 0.1%. A small excess of H_2O_2 over the amount necessary for oxidation of bivalent Fe present in the solution is maintained, e.g. an excess corresponding to 0.1-5 cc. 0.1N $KMnO_4$ solution for each 10 cc. of bath solution. In organic accelerators, e.g. nitrates, nitrites, chlorates and stabilizers for H_2O_2 can also be added.

4. *Protective Coatings On Zn and Its Alloys.* **By I. G. Farbenind A.-G. Belgium 444,465. March 31, 1942.**

The treating bath is composed of zinc phosphate and manganese acid phosphate.

5. *Improving the Resistance of Protective Phosphatic Coatings for Iron, Steel, Cast Iron and Iron Alloy Surfaces.* **By Farm-aceuntici Italia, Societa Anon. Belgium 444,643. March 31, 1942.**

The already phosphated articles are subjected to oxidation, carried out hot or cold, by wet, dry or gaseous process. Oxidation can also be carried out electrolytically.

6. *Phosphate Coatings on Metals.* **By Metallgesellschaft A.-G. Belgium 445,538. June 30, 1942.**

The free acid content of the solution is decreased as compared with that corresponding, in each case, to the state of equilibrium at usual working temperature. The pH is raised by 1 unit as compared with the pH value of solutions operating satisfactorily at higher temperature.

7. *Production of a Phosphate Coating on Cu and Cu Alloys.* **By Deutsche Waffen - und Muntionsfabriken. Belgium 446,256. July 31, 1942.**

The metals are held for a short time (10-20 minutes) in a 3-10% Fe Cl_3 solution, or heated to about 500°F. and are then phosphated.

*Gilbert, Lloyd O., "Phosphating," Rock Island Arsenal Laboratory Report No. 45-155, March 15, 1945.

**Numbered consecutively—alphabetically and chronologically by country.

8. *Phosphatization of Hollow Bodies.* By Metallgesellschaft A.-G. Belgium 449,970. April, 1943.

The rate of phosphatization is brought into relation with the speed of penetration of the solution into pores. The treatment is carried out with solutions which allow only a very slow formation of the phosphate covering.

9. *Phosphate Solutions.* By Metallgesellschaft A.-G. Belgium 449,971. April, 1943.

The solutions are prepared from a tertiary phosphate of heavy metal (Zn) which itself is prepared from superphosphate alkali sulfate, alkali carbonate and heavy metal compounds. The solutions are suitable as rust and corrosion inhibitors.

10. *Phosphate Coatings on Metals.* By Metallgesellschaft A.-G. Belgium 451,132. July, 1943.

Solutions of phosphates containing nitrates are sprayed on to a metal (more particularly Fe and Steel) with a gun at temperature below 50° with continuous re-utilization and regeneration, preferably by pumping in a closed circuit under a relative pressure of at least 0.7 atm.

11. *Protecting Metals Against Rust.* By L. M. A. Bleys. Belgium 509,990. July 16, 1952.

A metallic object is boiled in an aqueous solution of 3% Na_3PO_4 rinsed in H_2O, put in an aqueous solution of 40% HCl to remove rust, rinsed in water, and electrolyzed in an aqueous solution of ZnO 23%, cyanide 54%, NaOH 18%, and H_2Cl_2 0.05% at 30-40°F. with a current of 3 amps. 1 sq. dm. until 8 to 10 micro inches coating of zinc is obtained. This process can be continued and a coating of Sn can be obtained.

12. *Treatment of Iron or Steel for Prevention of Oxidation or Rust.* By Rudge Whitworth-H. L. Heathcote. British 490. January 8, 1908.

"Parts are immersed in a mixture of iron phosphates with other phosphates not specified."

13. *Process for Treating Iron & Steel to Prevent Rusting.* By G. Ross. British 3,119. October 29, 1869.

"Immersion of iron and steel into phosphoric acid of a concentration not specified."

14. *Treatment of Iron or Steel for Preventing Oxidation or Rusting.* By T. W. Coslett. British 8,667. April 10, 1906.

Iron filings and phosphoric acid are mixed to form ferrous di-phosphate on steel or iron to prevent oxidation or rusting.

15. *Treatment of Iron and Steel for the Prevention of Oxidation or Rust.* By H. L. Heathcote and Rudge Whitworth. British 9,926. April 24, 1914.

The phosphated objects are coated with linseed oil, either raw or boiled, and then dried.

16. *Treatment of Iron or Steel for Preventing Oxidation or Rusting.* By T. W. Coslett and Coslett Anti-Rust Syndicate. British 15,628. July 23, 1908.

"The objects of iron or steel, covered with phosphate coating, are immersed into a solution of chromic acid for a time varying with temperature and concentration."

17. *Process for the Treatment of Iron or Steel to Prevent Rusting.* By W. J. Bullock and J. Calcott. British 16,300. July 13, 1909.

Objects are immersed in boiling mixture of water, phosphoric acid, and iron filings. The objects are connected with the cathode, while the anode consists of an iron plate. Current density — 6 amp./dm.^{2}; 10 volts.

18. *Treatment of Iron & Steel for Preventing Oxidation or Rusting.* By R. G. Richards. British 17,563. August 2, 1911.

The parts are immersed into a boiling solution of manganese dioxide, phosphoric acid, and water.

19. *Coating Steel.* By G. D. Feidt. British 20,621. October 6, 1914.

Steel surfaces are prevented from rusting beneath a coating of paint by a preliminary treatment with an alcoholic solution of H_3PO_4. The solution may be applied with a brush, or by dipping and incrustations of rust may be removed by rubbing with an emery cloth in the presence of the solution.

20. *Treatment of Iron or Steel to Prevent Oxidation or Rusting Thereof.* By T. W. Coslett (Coslett Anti-Rust Syndicate). British 22,743. October 6, 1909.

First to realize the importance of free phosphoric acid and the necessity of controlling the activity. The phosphating solution is the same as British Patent 8,667, April 10, 1906.

21. *Protective Coating on Iron and Steel.* By F. R. G. Richards and M. A. Adams. British 25,134. November 4, 1913.

Forming a protective coating on iron and steel by exposure to the action of a solution of a Mn compound, such as $MnCO_3$ or of metallic Mn in H_3PO_4. The solution may contain a relatively high percent of Mn compound and also a considerable quantity of free acid, and MnO_2 may be added to the bath.

22. *Treatment of Iron or Steel to Prevent Rusting or Oxidation.* By T. W. Coslett. British 28,131. December 2, 1909. French 432,241. December 1, 1910. German 248,856. December 2, 1910.

Iron and steel are subjected to the action of phosphoric acid in the presence of zinc and zinc compounds.

23. *Treatment of Iron and Steel for the Prevention of Oxidation.* By H. L. Heathcote and Rudge Whitworth. British 29,504. December 19, 1910.

Immersion of iron and steel in boiling solution of phosphates of iron — plus additions of an alkaline carbonate or hydrate.

24. *Tanks for Rust Proofing Metals.* By W. C. Parker. British 103,288. January 12, 1916.

This patent describes some constructional details of tanks used for phosphate treatments. They relate to lateral heating of the solution so as not to move the sediment prevailing in the form of "sludge" at the bottom of the phosphate treating tanks.

25. *Cleaning Metals for Paint.* By American Chemical Paint Co. British 107,921. December 7, 1916.

Steel to be painted is cleaned by applying strong solution of ortho-, pyro-, or meta-, phosphoric acid in water, alcohol, or other solvent, and removing the products of the action by applying relatively weak solution of ortho-phosphoric acid.

26. *Cleaning Metals.* By G. S. Gilmore, G. Alexander, and T. G. Alexander. British 174,489. November 22, 1920.

A pickling fluid for cleaning metal surfaces, more particularly for preparing Al and Al alloys for soldering, consists of an aqueous solution of ortho-phosphoric acid, HNO_3, and HOAc. Formic acid may be employed in addition to, or instead of, HOAc, and in the same proportions. The bath may consist of the following parts by weight: ortho-phosphoric acid 60-90, HNO_3 20, HOAc 5-10, and H_2O 250.

27. *Method of Preserving Steel and Iron Works Against Corrosion and Rusting.* By G. H. Howse. British 179,811. May 2, 1921.

The parts are covered with a mixture of phosphoric acid, chromium oxide or hydroxide which is dissolved in a solvent such as acetone or alcohol.

28. *Treatment for Obviating the Rusting or Oxidation of Iron and Steel.* By W. R. Brunskill. British 182,988. May 10, 1921.

The parts are treated with a boiling solution containing 1% double ortho-phosphate of zinc.

29. *Preventing Rusting of Iron and Steel.* By T. W. Coslett. British 247,071. June 26, 1925.

Iron or steel articles are treated with a solution of acid zinc phosphate to which H_3BO_3 or borax may be added. An electric current may be used to promote formation of a coating and the articles may be preliminarily treated with a hot or cold H_3BO_3 solution.

30. *Process for Rustproofing Iron and Steel.* By Matthew Green and H. H. Willard (Parker Rust Proof Co.). British 270,679. April 24, 1927.

In this patent and the various patents referred to in this patent, the preparation of ferrous-manganous hyperphosphate is described, starting from phosphoric acid and an alloy of iron and manganese. In addition, the varying phosphate treatments involving these compounds are described.

31. *Process for Rustproofing Iron and Steel.* By M. Green and H. H. Willard (Parker Rust Proof Co.). British 270,680. April 25, 1927. (See British 270,679)

32. *Production of High Acid Phosphate.* By C. R. Marks (Parker Rust Proof Co.). British 270,820. February 16, 1926.

Diphosphates of manganese are prepared by dissolving the metal in phosphoric acid allowed to crystallize and dry.—"*Parco Powder*"

33. *Rustproofing Iron.* By C. R. Marks (Parker Rust Proof Co.). British 273,168. February 18, 1926.

Same as British 270,820 except double orthophosphates were used.

34. *Proofing of Iron and Steel Against Rust.* By W. H. Cole. British 289,906. January 1, 1927.

The articles are immersed into a solution containing acid phosphates of aluminum, zinc, iron or chromium.

35. *Cleaning Iron and Steel.* By J. H. Gravell. British 290,458. June 24, 1927.

"An acid oil solvent, and adhesive and "control agent" are used together. For example H_3PO_4 may be used with EtOH or BuOH or

both, an adhesive size, starch or gelatin and quinoline, pyridine, As_2O_3 CH_2O or thiocyanates.

36. *Rustproofing Iron and Steel.* By W. H. Cole. British 298,328. August 22, 1927.

The process described in British 289,906 is carried out under super atm. pressure and at a temperature higher than the normal boiling point of the liquor used.

37. *Rustproofing Iron and Steel.* By W. H. Cole. British 305,386. February 28, 1928.

In a process such as described in Brit. 389,906 a solution is used which is prepared from FeO 25, ZnO 15, CrO 1 and Al, 1 part, separately dissolved in H_3PO_4. The parts are further treated with $K_2Cr_2O_7$, K_2CrO_4, NH_4 phosphate or napthalene.

38. *Rustproofing Iron and Steel.* By W. H. Cole. British 328,580. January 1, 1929.

In a modification of the processes described in Brit. 289,906 and Brit. 305,386, separate solutions are made of each of the metals Al, Zn, Fe in H_3PO_4 of 45° Bé diluted in 22° Bé with water, until the phosphate solutions are each of a dilution of 36°F. Bé. Various details of procedure are given.

39. *Detergents for Metal Surfaces.* By C. F. Dinley. British 340,323. September 28, 1929.

Rust and oil are removed from metal surfaces by applying an aqueous paste comprising of: (1) a rust removing acid such as H_3PO_4, (2) a liquid organic oil and grease solvent such as an alcohol, ketone, ester, (3) finely divided inert mineral matter such as cryolite, silica, fullers earth, etc. The compound is dried on the metal until it is friable and is then removed. Metal salts such as ferric phosphate also may be added.

40. *Manufacture of Coated Iron and Steel Articles.* By T. W. Triggs (Parker Rust Proof Co.). British 350,559. March 14, 1930.

The parts are immersed into a diluted solution of an acid phosphate containing colloidal orthosilicic acid.

41. *Manufacture of Coated Iron and Steel Articles.* By Parker Rust Proof Co. British 350,565. March 14, 1930.

The pieces are placed in a boiling solution of phosphoric acid and ferrous acid diphosphates containing a small quantity of copper phosphate.

42. *Coating Metals to Prevent Corrosion.* By J. H. Gravell. British 355,286. March 4, 1930. German 561,443. June 19, 1930.

A coating compound is prepared from H_3PO_4, a waterproof material such as stearin pitch or other pitch or resin which dissolves H_3PO_4 and a solvent such as benzene, gasoline or kerosene and fillers and pigments of various kinds also may be added. The coating may be heated to 322° to decompose the H_3PO_4 to pyro or metaphosphoric acid and an overlying coating of cellulose lacquer may be added.

43. *Rust Proofing the Surfaces of Iron, Steel and Alloys Thereof.* By J. V. Johnson (I. G. Farbenindustrie A.G.). British 359,987. May 2, 1930.

Phosphoric acid is heated to 400-600°C. in an atmosphere of nitrogen, phosphine, hydrogen or oxide of carbon.

44. *Rust Proofing Iron or Steel Surfaces.* By Pyrene Co. Ltd. (Parker Rust Proof Co.) British 362,746. January 23, 1931.

The parts covered with layer of phosphate containing metallic copper are dipped into a hot, diluted solution of potassium dichromate.

45. *Coating Metals.* By Metal Finishing Corporation. British 386,739. January 26, 1933.

(See French 724,422.)

46. *Rust Proofing Compositions.* By William I. Walters. British 419,487. May 13, 1936. British 447,176. May 13, 1936.

The compound is prepared by dissolving Fe sulfide in a concentrated aqueous solution of H_3PO_4 or by dissolving Fe or an Fe compound other than the sulfide in H_3PO_4 and adding sulfide of Na, K, or Ca, either during the reaction or subsequently. The solution is filtered and, when required for rustproofing is diluted. Na_2CO_3 may be added to the solution at the time of application.

47. *Prevention of Rusting of Ferrous Metals.* By J. H. Tuckner and J. N. R. Haman. British 420,461. December 27, 1934.

After the treatment, the parts are immersed into a colloidal solution of graphite in linseed oil.

48. *Phosphate Coatings on Metals.* By Herbert T. Davies. British 438,816. November 25, 1935.

Metals that are to be coated with a surface layer of phosphate by treatment with H_3PO_4 or a phosphate solution are preliminary immersed from a few seconds to a few minutes in a diluted solution of a copper or a nickel salt, or a solution containing both Cu or Ni salts. Zinc salt may also be added to the Cu or Ni salt solution. An electric current is preferably used to hasten the action, the article being made the cathode. After the phosphate coating is formed, the metal may be immersed in oil at ordinary or elevated temperature.

49. *Baths for Producing Phosphate Coatings on Ferrous Articles.* By Frederick D. Waterfall. British 440,215. December 23, 1935.

The bath is formed by dissolving in water, 1 or more of the acid phosphates of Ca, Sr and Ba. One or more of the sulphates of Zn, Mn, Cd, and Fe may be added either in such amount that the bath contains a mixture of acid phosphates of Ca, etc., and acid phosphates of Zn, etc., or in such amount as to complete precipitation of the Ca, etc. The bath consisting of the acid phosphate of Zn, etc., with or without an excess of sulphate. An oxidizing agent, e.g. nitrate, nitrite, chlorate, or iodate may be added to oxidize the H evolved.

50. *Rust Preventing.* By Victor Chemical Works. British 447,704. May 25, 1936.

(See French 788,036.)

51. *Cleaning Metals.* By Rust Proofing Co. of Canada Ltd. British 464,892. April 26, 1937.

(See French 797,098.)

52. *Rust Removing and Rustproofing Compositions.* By The Grasselli Chemical Co. British 467,839. June 23, 1937.

A mixture of H_3PO_4 and a sulfation product of an alcohol containing 6 or more C atoms is used for rust removing or rustproofing. In modifications, salts of the sulfation products or products obtained by sulfonating esters of the higher alcohols or ester-alcohols such as octadenyl and hexadenyl glyceryl esters may be used. In the case of the esters, e.g. octylacetate, hydrolysis takes place simultaneously with sulfonation. In examples (1) a sulfonation product of a mixture of stearyl and cetyl alcohols is mixed and heated with H_3PO_4 solutions and (2) H_3PO_4 is mixed with the Na salts of the sulfonation products of alcohols containing 12-18 C atoms.

53. *Phosphatic Coatings on Metals.* By The Pyrene Co. Ltd. British 473,974. October 22, 1937.

A coating bath or replenishing liquid for use in a phosphatizing process consists of a solution containing 1 or more metallic dihydrogen phosphates, e.g., of Zn, Fe, Mn, Ca, Cd, or Ba to which has been added HNO_3 in quantity sufficient to avoid the presence of insoluble phosphates formed by hydrolysis. Alternatively, 1 or more soluble metallic nitrates and H_3PO_4 in quantity sufficient to inhibit hydrolysis may be added to the solution.

54. *Coating Ferrous Metals.* By Wilfred J. Clifford (The Pyrene Co. Ltd.). British 477,910. January 10, 1938.

In subjecting the metals to a bath containing the phosphate of a metal above Fe in the electrochemical series, the $Fe(H_2PO_4)_2$ content of the bath is reduced by the periodic addition of an oxidizing agent apart from and in addition to the usual replenishing of the bath. The amount of oxidizing agent added is preferably insufficient to oxidize all the $Fe(H_2PO_4)_2$. $KMnO_4$ is preferably added when the bath contains $Mn(H_2PO_4)_2$ and H_2O_2 when it contains $Zn(H_2PO_4)_2$. The bath may contain a weak oxidizing agent, e.g. $NaNO_3$, to reduce or inhibit the formation of a H blanket on the work according to British Patent 386,739.

55. *Forming Phosphate Coatings on Iron.* By Parker Rust Proof Co. British 484,726. May 10, 1938.

In applying phosphate coatings to ferrous articles by immersion in a solution containing at least 1 acid phosphate not oxidizable in air, the ferrous phosphate content of the solution is kept low by withdrawing solution from the tank, spraying it through the atmosphere and returning it directly or indirectly to the tank, the ferrous phosphate being oxidized to ferric phosphate during the spraying. The invention is advantageously applicable in the case of a phosphate solution composed, e.g. of $Zn(H_2PO_4)_2$, $NaNO_3$ and CuO_2.

56. *Coating Iron and Steel Surfaces.* By Herbert Davies. British 494,503. October 25, 1938.

To protect the surfaces against corrosion a phosphate coating is first formed and then followed by a protective coating comprising of Pb, Sn, Te or Sb. The phosphatizing may be effected chemically or electrolytically, e.g. with a hot 3% solution of mixed acid phosphates of Fe and Mn. The surface is then rinsed and dried prior to the deposition of the outer coating.

57. *Phosphoric Acid Baths.* By Rene J. Kahn. British 507,355. June 14, 1939. French 829,686. July 4, 1938.

Protection against corrosion in acid baths used for treating metals is obtained by the presence in the baths of hyposulfurous acid.

58. *Coating Metals.* By Wilfred J. Clifford and Henry H. Adams (The Pyrene Co. Ltd.). British 510,684. August 4, 1939.

The resistance of metal to corrosion is improved by treating it with a phosphate coating solution, the action of the solution being accelerated by means of an accelerating agent in which there is directly attached to H or a hydrocarbon residue an accelerating group that is nonionic group (other than a cyanide or isocyanide) group that, if substituted into a C_6H_6 ring, would have a meta-directing influence to typical electrophilic reagents. Several groups and compounds are mentioned.

59. *Coating Metals.* By American Chemical Paint Co. British 512,594. September 20, 1939.

The ferrous metallic bearing or rubbing surface of a machine part is treated to produce thereon a substantially integral wear-resistance lubricating coating by forming therein, e.g. by immersion, spraying, or electrolytic deposition.

60. *Improving the Resistance of Metals to Corrosion.* By The Pyrene Company, Ltd. British 517,049. January 18, 1940.

The metal surface is treated with a solution which is primarily one of phosphoric acid or a non-coating phosphate (a phosphate in which the metal present does not enter into the protective coating) or both and which contains also a small amount of a nitrite, nitrate or sulfate but which contains at the most only a small amount of metals which form coating phosphates.

61. *Treating Iron or Steel Surfaces.* By Clete L. Boyle. British 517,916. February 13, 1940.

A method of preparing a steel surface for painting comprises subjecting the surface covered with an oxide coating to a mechanical treatment which removes from it the loose coating material and leaves the coating which adheres tightly. Applying to the adherent coating a sufficient quantity of water solution containing phosphoric acid and a wetting agent and allowing the solution to remain upon the coating until it dries. The phosphoric acid constituent is present in the solution in an amount which is sufficient to convert the oxide coating into a phosphate coating.

62. *Phophate Coatings on Iron or Zinc.* By American Chemical Paint Co. British 522,954. February 13, 1940.

The surface of the Fe, Zn or an alloy thereof, is treated with an acid aqueous solution containing ($COOH_2$) (I) and without intermediate mechanical treatment of the surface subjected to the action of a phosphate solution. A wide variety of inorganic or organic substances may be used in conjunction with (I).

For steel stamping for use on an automobile body a solution of 1 oz. (I) to 1 gallon of water is employed as the immersion bath at 180°F. The stamping is held therein 15 sec., then immersed in a phosphate solution formed from ZnO 1.5, phosphoric acid (75%) 6.7, and water 4.7 lbs. for 7-10 minutes.

63. *Phosphatizing Baths.* By Rene Jacques-Kahn. British 526,326. September 16, 1940.

A mixture is added to the phosphatizing bath in a regular manner preferably before each operation, such mixture containing a product or products neutralizing the prejudical excess of acidity and a product or products furthering the phosphatizing process. Manganese carbonate is chiefly employed to renew the bath containing phosphates of Fe, Zn or Mn. A salt of hyposulfurous acid optionally combined with an aldehyde or a nitrate is a good accelerating agent.

64. *Rustproofing of Ferrous Surfaces Prior to Painting or Enameling.* By Samuel T. Roberts. British 526,815. September 26, 1940.

The articles are immersed into a hot solution at about 140-208°F. produced by adding to phosphoric acid 1-6 grams per liter of Zn and Mn salts, preferably the carbonates and 0.05 to 0.40 grams/liter of Co and (or) Ni salts, preferably the carbonates. Oxidizers may be employed.

65. *Converting Zinc, Zinc Alloy or Galvanized Surface to a Paint-Receptive One.* By Samuel T. Roberts. British 526,816. September 26, 1940.

The article is immersed in a solution at a temperature of about 140-200°F. Containing phosphates of Zn, Mn, Co and (or) Ni and a little phosphoric acid. These salts are produced by adding Zn and Mn salts, preferably the carbonates, and the carbonate of Co and (or) Ni to a bath of phosphoric acid. Also Cd, Cd alloy or galvanized surfaces may be similarly converted by using instead of phosphates of Cd, Mn, Co and (or) Ni and a little free phosphoric acid. The latter salts are produced by adding Cd and Mn salts and carbonates of Co and (or) Ni to a bath of phosphoric acid.

66. *Improving the Resistance of Metal Surfaces to Corrosion.* By Pyrene Company Ltd. British 530,006. December 3, 1940.

A protective film is formed on the metal from a solution prepared by dissolving in water a dihydrogen orthophosphate of the metal and chromic acid or alternatively orthophosphoric acid in conjunction with a chromate or dichromate of the metal. The film is dried on the metal surface which becomes an excellent base for paints, lacquers and similar finishes.

67. *Improving the Resistance to Corrosion of Iron or Steel.* By Parker Rust Proof Co. British 534,852. March 20, 1941.

The iron or steel is treated first with a solution containing a metal below Fe in the electromotive series and then with a solution containing orthophosphate radicals and radicals containing sexivalent Cr, and the phosphate chrome solution is then dried on the surface without removing it.

68. *Improving the Resistance of Metals to Corrosion.* By The Pyrene Company Ltd. British 534,883. March 20, 1941.

A film of an aqueous solution of orthophosphoric and chromic acids having a visible etching action on the metal is applied to and dried on the surface of the metal.

69. *Coating for Iron or Steel.* By The Pyrene Company Ltd. (Parker Rust Proof Co.) British 547,408. August 26, 1942.

A chromate coating is formed on iron or steel by applying electrolytically a plate (.0001 thick) of Cd, Ni, Sn, Pb, or Cu to the iron or steel and applying over this plate a coating solution including radicals containing trivalent and sexivalent chrome and orthophosphate radicals.

70. *Surface Treatment of Magnesium and Magnesium Alloys.* By John G. Bedford, Ralph C. Storey and Ralph W. D. Kirkham (Yorkshire Deleware Chemical Co.) British 548,479. October 12, 1942.

Corrosion of Mg articles are prevented by immersing the article in a bath containing H_3PO_4 until a satisfactory deposit of Mg phosphate is formed on the surface of the metal which is then heated to dehydration.

71. *The Application of Phosphate Coatings to Ferrous Metal Surfaces.* By American Chemical Paint Co. British 550,751. January 22, 1943.

A continuously operable method for rapidly coating ferrous metal surfaces with an adherent, water-insoluble, metallic phosphate is described. The method is especially applicable to the coating and finishing of automobile bodies and fenders and metal cabinets for refrigerators, radios and washing machines.

72. *Production of Coatings on Metal Surfaces.* By Parker Rust Proof Co. (The Pyrene Co. Ltd.) British 551,261. February 15, 1943.

An insoluble phosphate coating is produced on a metal surface by spraying it with $ZnH_4P_2O_8$ solution containing a nitrate or nitrite together with a chlorate at a temp. of 115-130°F. The pH value of the solution is maintained between 2.5 and 2.9 by the continuous addition of a neutralizing agent for H_3PO_4 and the solution is circulated and resprayed.

73. *Coating on Ferrous Surfaces.* By Parker Rust Proof Co. (Pyrene Co. Ltd.) British 552,569. April 14, 1943.

Ferrous metal surfaces are coated by spraying with a solution of $Zn(H_2PO_4)_2 \cdot 2H_2O$ and permanganate. The zinc constituting from 0.2 to 0.3% of the solution and the permanganate from 0.0005 to 0.005% of the solution. The pH of the solution is maintained from 0.12 to 0.38 above equilibrium.

74. *Method of Producing Phosphate Coatings on Ferrous Metal Surfaces.* By Gerald C. Romig (American Chemical Paint Co.) British 554,654. July 16, 1943. (See U. S. 2,326,309.)

75. *Coating Ferrous Surfaces.* By Parker Rust Proof Co. (Pyrene Co. Ltd.) British 554,734. July 16, 1943.

Ferrous articles are rendered resistant to corrosion by electrolytically applying a layer of Zn, not more than 0.0001" thick, and then forming a thin continuous fine grained phosphate coating, not exceeding 1.5 grams per sq. yard in weight on the zinc by chemical reaction without destroying the continuity of the Zn layer.

(To be continued)

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Chlorides in Copper Solutions

Question: In event that muriatic acid were being dragged into a cyanide copper bath, what would be the consequences in addition to a reduction in pH? Can chloride introduced in this matter be eliminated by any practical means? E. J. M.

Answer: Because of the accumulation of carbonates in a cyanide copper plating solution, which have a buffering action, small amounts of drag-in from an acid dip will have very little effect on the pH. However, chlorides will tend to produce coarse deposits, when present in appreciable amounts, and cannot be removed from the solution. They also may hasten attack on the tank, if of unlined steel construction.

If acid drag-in is a problem, it is suggested that sulfuric acid be used rather than muriatic acid prior to copper plating, since sulfates will not affect the deposit.

Stripping Chromium

Question: Every so often I have some work that is partially chrome plated or rainbow color. I have been using 100% muriatic acid to strip, then water rinse and rechrome, but the muriatic acid does not last too long this way. I would rather remove the chrome in a caustic cleaner (reverse) and then I want to activate the nickel so that I can rechrome again.

I was wondering if there is any other way that I can activate the nickel other than muriatic acid.

R. A.

Answer: If reverse current is used to remove chromium plate, the nickel undercoating can be reactivated by direct current at 6 volts in a solution of about 8 oz./gal. of sodium cyanide. If the muriatic acid strip is warmed, it will last much longer and does not have to be full strength.

Laminated Nickel Deposits

Question: Enclosed are representative samples of brass parts which have been barrel nickel plated at our plant. A troublesome flaking problem has been encountered, as can easily be seen by crimping the smaller diameter. The plating specification requires full coverage on all inside diameters.

The plating is done in a horizontal, dangler cylinder under the following conditions, using a proprietary brightener:

Nickel sulphate	40 oz./gal.
Nickel chloride	8 "
Boric acid	5 "
Magnesium sulphate	16 "
Temperature	135° F.
Voltage	12 volts
Current	250 amps.

Any assistance you can offer in solving this problem will be greatly appreciated.

F. B.

Answer: Flaking of the nickel deposits is due to lamination. This condition is commonly experienced in barrel plating when the brightener content is on the high side, especially if there is cadmium present.

It is suggested that this be checked with the supplier of the brightener.

Brass on Bright Nickel

Question: In plating brass for wire goods with bright nickel undercoat, we have difficulty in putting a successful finish on the mesh, which is usually made of expanded metal, particularly when the mesh is in a horizontal plane in relation to the legs; when it is brass finished the mesh hasn't that "brassy" look which we want, but has a coppery tinge. We haven't any other trouble in finishing any other items in the wire goods field.

H. J. H.

Answer: A coppery brass deposit in low current density areas which have a precoat of bright nickel is usually due to passivity of the nickel surface or to an out-of-balance brass solution. It is suggested that both solutions be analyzed for regular constituents and impurities.

Increasing the current density in the nickel solution often helps in cases where impurities are resulting in passive low-curren-density areas.

Etching for Hard Chromium

Question: Will you be kind enough to let us know if we can use a steel tank for both cathode and container (28 oz./gal. chromic acid) to etch our work before going in the plating tank in doing hard chrome.

M. P. C.

Answer: An unlined steel tank is suitable for the chromic acid etch prior to hard chromium plating and can be made the cathode. For deep work, however, it may be advisable to place an insulating sheet on the bottom of the tank. This will avoid passage of excessive current between the tank and bottom of the work.

Brown Stains in Lacquer Coating

Question: To what would you attribute brownish stains in lacquer coatings? They only appear at irregular intervals and usually correct themselves before it becomes very serious.

G. L. K.

Answer: When an air compressor emits oil into the lines clear lacquer coatings, especially, show brown streaks or stains. If your air compressor is at fault, drain the oil and water separator daily. If the material itself is at fault, this can be detected by pouring the lacquer into a transparent container and viewing it for any inconsistencies.

Improving Insulation Properties of Varnish Coatings

Question: We have been coating our product with an insulating varnish for two years and have experienced only infrequent dielectric breakdown test failures. Recently, however, 50-100% of each batch fails to meet our insulation requirements. Our cycle is:

1. Degrease in trichlorethylene
2. Dip coat with insulating varnish (removal speed, six inches per minute)
3. Force dry with infra-red heat

What should be changed in our coating procedure in order to improve our insulation properties?

P. J.

Answer: Since insulation properties of a varnish coating are improved with heavier and denser films, we may assume that one or both of these properties should be modified. If bubbles appear in the coating (even though barely perceivable under magnification) improper coating application and/or drying may be the cause. To alleviate this, it is suggested that the viscosity of the material be adjusted and the rate of part withdrawal reduced so that a uniform coating with sufficient solids content results. Your force drying operation may be too severe and if the peripheral surface of the varnish coating has completely set, entrainment of solvent may account for lower dielectric strength. It is therefore suggested that accelerated drying in this fashion be either eliminated or modified, so that the condition of local setting is minimized.

Chromic Acid Stains

Question: I would appreciate any information on either soaps or liquids for the removal of chromic acid stains from the hands.

A. G.

Answer: Fresh chromic acid stains on the hands can be lightened by application of mild alkaline cleaners, or with a reducing agent such as sodium sulfite or thiosulfate.

Old stains cannot be removed from the hands without injuring the skin, but will disappear in a day or so.

Cadmium and Zinc Plating

Question: We are plating zinc and cadmium, both still tank and barrel, and I am planning on installing a hoist system for both lines, using tanks about 7 ft. long and 4 ft. deep in the still line. I would like to be able to plate both cadmium and zinc using the same cleaning rinse tanks. I would not plan on using them at the same time, and the one not in use would be covered by a plastic top plus a plastic fabric covering. Can I do this without running into plating trouble?

I expect to have a 3 bar zinc tank and plan on using steel anode bars under the surface of the zinc solution. I would like to make this tank flexible so that I could convert it to a two or a one bar tank to handle large pieces.

W. D.

Answer: We would suggest that you place the zinc tank before the cadmium tank since zinc in the cadmium solution will have no effect, whereas, if some cadmium solution drips into the zinc tank you may run into rough deposits because the cadmium may precipitate out on the zinc anodes. With the zinc tank before the cadmium tank, there is no possibility of carrying dripping cadmium plated work over the zinc tank.

It is advisable to use short upright pieces at the end of the anode rods so that connections can be made outside of the tank. Rods made of threaded iron pipe can be constructed with elbows and nipples to the proper shape. The center anode rod can be tied into the bus bar with a flexible cable so that it can be shifted or removed.

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Patents

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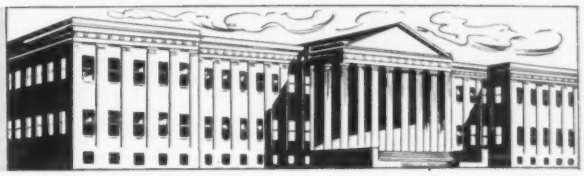


Paint Applicator

U. S. Patent 2,805,436. *Sept.* 10, 1957. *J. J. Christensen and H. E. Christensen.*

A wall paint applicator including a substantially U-shaped frame comprising a pair of laterally adjustable legs having inturned, lapped relatively slidably adjustable inner end portions, oppositely extending guides integral with the free ends of said inturned end portions and operable in the slots, an elongated handle, a threaded, projecting stud fixed longitudinally in one end of said handle, an applicator roll journaled between the legs of the frame, and a distributing roll journaled between said legs of said frame and having rolling contact with said applicator roll.

Paint Roller

U. S. Patent 2,805,439. *Sept.* 10, 1957. *W. E. Parker*

A device for applying a coating material to a pipe or similarly curved surface comprising a handle, a longitudinally curved shaft, a tri-furcated support means extending from said handle and supporting said shaft at each of its opposite ends and in the middle thereof whereby said shaft is fixed against rotation, a plurality of rollers rotatably mounted on said shaft on each of the opposite sides of the middle support means, and a sleeve of fibrous material on each of said rollers.

Polishing Wheel

U. S. Patent 2,805,530. *Sept.* 10, 1957. *P. E. Schaffner, assignor to Schaffner Mfg. Co., Inc.*

As an abrasive article of manufacture particularly for polishing irregular surface, a wheel comprising a plurality of helically wound plies of flexible abrasive coated fabric in the nature of emery cloth which are folded along a median line and constricted along said line to form an annulus of pleated plies extending loosely from the inner to outer periphery, said inner periphery being mounted on a pair of disks which cooperate to clamp and support said annulus upon a power driven arbor, all of said plies being coated with abrasive.

Spray Booth

U. S. Patent 2,805,844. *Sept.* 10, 1957. *W. D. McMaster, assignor to General Motors Corp.*

A spray booth comprising the combination of a spray compartment having means therein for providing at least one generally vertical liquid curtain adapted to entrap coating particles, air scrubbing means, a liquid reservoir adapted to receive the discharge from said curtain and air scrubbing means, and a circulating pump.

Acid Inhibitor

U. S. Patent 2,805,915. *Sept.* 10, 1957. *G. H. Rohrback, assignor to Crest Research Laboratories, Inc.*

An inhibitor of acid attack on ferrous metal surfaces, comprising a new chemical compound represented by the formula:

$$X_2B_4O_7{\cdot}2A_{S2}O_3$$

wherein X is a cation selected from a group consisting of the alkali metals and ammonium.

Emulsion Coating Composition

U. S. Patent 2,806,008. *Sept.* 10, 1957. *J. D. McNulty and E. A. Wich*

A plastic coating composition capable of keeping without setting in tightly sealed containers, said composition consisting essentially of from 21 to 10 parts by weight of a mixture of wood flour with plaster of Paris, the ratio of wood flour to plaster of Paris in said mixture ranging from 1:1½ to 1:4; a resin solution immiscible with water consisting essentially of from 8.5 to 16 parts of a water insoluble thermoplastic resin selected from the group consisting of the homopolymers of vinyl acetate and of vinyl chloride, the copolymers of vinyl acetate with vinyl chloride, the homopolymers of the lower alkyl methacrylates, the homopolymers of styrene, the copolymers of a lower alkyl methacrylate with styrene and a drying oil, and mixtures thereof, said resin being dissolved in from 43.5 to 56 parts of a volatile organic solvent which is eliminated on drying of said composition; from 27 to 18 parts of water; and an effective amount of an emulsifying agent for dispersing in said water both said resin solution and said plaster, said resin solution then coating said plaster particles and thereby separating said plaster particles from said water to make possible the said keeping of said composition without setting.

Pickling Stainless Steel

U. S. Patent 2,806,000. *Sept.* 10, 1957. *M. A. Streicher, assignor to E. I. du Pont de Nemours & Co.*

The method of cleaning stainless steel comprising incorporating in an aqueous phosphoric acid solution, in concentration up to and including about 85% by weight phosphoric acid, a ferric ion-contributing salt other than an iron halide in an amount sufficient to yield from about 1.0 to 10.0 grams per liter of ferric iron in said solution, and thereafter contacting said stainless steel with said solution.

Rotary Painting Brush

U. S. Patent 2,806,236. *Sept.* 17, 1957. *J. V. Di Stefano*

An assembly for the power application of paint to a surface comprising, in combination, a paint reservoir, an applicator including an elongate handle providing a gripping means for manipulation of the device, and a rotor-brush assembly.

Method of Making Cloth Buffs

U. S. Patent 2,806,332. *Sept.* 17, 1957, *J. J. Lawler, assignor to Ajax Buff Co.*

The method of manufacturing a buff ring comprising the steps of winding a length of cloth material on a mandrel to provide a tubular ring of

multi-ply fabric of a predetermined circumference, holding the plies of said tubular ring together at one edge of said tubular ring and simultaneously pleating and stitching said one edge to reduce said one edge to a uniform desired reduced internal circumference.

Guard Attachment for a Paint Applying Roller

U. S. Patent 2,807,040. *Sept.* 24, 1957. *J. E. Adams and C. E. Garton*

An attachment for a paint applying roller having a handle extending substantially at right angles to the roller intermediate its ends and a transverse arm carrying the handle and roller and spaced from the periphery of the roller, and a guard adapted to be disposed between the periphery of the roller and said arm.

Guide Attachment for Paint Brushes

U. S. Patent 2,807,041. *Sept.* 24, 1957. *P. Watro*

A guide attachment for a paint brush comprising an elongated extension plate and mounting means adjacent one end of said plate for connecting said plate to a brush handle for selective longitudinal adjustment therealong.

Paint Brush Holders

U. S. Patent 2,807,431. *Sept.* 24, 1957. *J. J. McHale*

A paint brush hanger comprising a U-shaped bracket adapted in inverted position to straddle the wall of a paint container, the arms of said bracket being substantially straight with the free ends of said arms being turned inwardly toward each other for engaging the opposite sides of the wall of the container with the major portions of the arms spaced from each other to clear the rim of the container.

Aluminum Bath

U. S. Patent 2,807,575. *Sept.* 24, 1957. *C. S. Charlton and N. F. Murphy, assignors to Research Corp.*

The method of electroplating aluminum on a base of suitable material which comprises passing an electric current between an aluminum anode and a cathode of said base material maintained in a molten mixture consisting of from about 50 to about 90 per cent aluminum chloride, from about 5 to about 50 per cent sodium chloride, and from about 0.05 to about 1.0 per cent vanadium pentoxide at a current density of from about 5 to about 100 amperes per square foot.

Bright Silver Plating

U. S. Patent 2,807,576. *Sept.* 24, 1957. *O. Kardos, assignor to Hanson-Van Winkle-Munning Co.*

A process for producing bright silver electrodeposits which comprises electrodepositing silver from an aqueous cyanide silver plating bath containing 0.01 to 0.16 oz./gal. (0.075 to 1.25 g./l.) of the water- and acid-insoluble but alkali-soluble reaction product of a ketone of the formula RCH_2COCH_2R', where R and R′ are substituents selected from the group consisting of alkenyl, aryl, and alkali metal carboxymethyl, with carbon disulfide and alkali hydroxide, this reaction product having been freed from alkali sulfide and hydrogen sulfide.

Electrostatic Spraying

U. S. Patent 2,808,343. *Oct.* 1, 1957. *C. C. Simmons, assignor to Ransburg Electro-Coating Corp.*

A method for electrostatically spray coating a plurality of articles comprising, providing an electrode, bodily and sequentially transporting articles in a looped path to simultaneously position a plurality of such articles around and substantially equidistant from said electrode, creating an electrostatic field extending between said electrode and said articles, and introducing atomized liquid coating material particles into said field for movement from adjacent said electrode to the articles to be electrostatically deposited thereon while maintaining the articles around said electrode, simultaneously to apply coating material to said articles.

Acid Inhibitor

U. S. Patent 2,807,585. *Sept.* 24, 1957. *G. S. Gardner and A. J. Saukaitis, assignors to American Chemical Paint Co.*

An acid corrosive to metals containing, as an inhibiting agent, the reaction product formed by heating at temperatures of from 60°C. to 150°C. for a period of time of from five minutes to twenty-four hours a substituted 4-hydroxy piperidine, and aryl and aryl-alkyl radicals in which the aryl moiety contains no more than eleven carbon atoms.

Abrasive Finishing Machine

U. S. Patent 2,807,915. *Oct.* 1, 1957. *A. J. Lewis, III, assignor to The Autoyre Co.*

Mechanism for abrasively finishing the surface of an elongated work piece including a bracket having an aperture for the work piece, means for reciprocating the bracket along the longitudinal axis of the work piece, an abrading head including a plate having an aperture for the work piece and an open ended slot extending from said plate aperture to the outer edge of the plate.

Dispenser for Abrasive Grit

U. S. Patent 2,808,969. *Oct.* 8, 1957. *F. J. Moravecky*

A dispenser suitable for abrasive material, comprising a hopper provided with a bottom discharge opening, a measuring box mounted below said opening and having in its top an inlet normally registering with that opening, the bottom of the box having an outlet, a resilient roller beneath the box extending across it and normally closing its outlet, and means for moving the box across the roller to open the box outlet.

Degreasing Machine

U. S. Patent 2,808,064. *Oct.* 1, 1957. *T. J. Kearney, assignor to Detrex Chemical Industries, Inc.*

A machine for degreasing work objects comprising an enclosure having a pair of spaced, opposed walls, a rotatable frame pivotally mounted for rotation about a transverse axis in said enclosure, a work objects carrier connected to said frame for movement in a substantially circular path around said axis and means in said enclosure for contacting and treating said work objects with a hot degreasing solvent.

Hot Dip Coating Wire

U. S. Patent 2,808,805. *Oct.* 8, 1957. *J. P. Tesmer*

An apparatus for applying metal coating to wire, including a vessel adapted to contain a bath of molten coating metal and a sink roll suspended in said vessel and under which the wire is adapted to pass.

Flexible Abrasive Wheel

U. S. Patent 2,808,689. *Oct.* 8, 1957. *G. G. Thomson and D. P. Latessa*

A method of making flexible abra-

sive wheels from flaps of fabric coated on at least one face with abrasive grits which are bonded thereto and in which wheel the flaps are assembled in an annular row with their inner end portions in face to face relation.

Paint Brush Holder

U. S. Patent 2,808,960. *Oct.* 8, 1957. *H. C. Wilson*

The combination with a container having an open top and a bail supporting projection adjacent the open top. of a paint brush holder comprising a vertically disposed rod adapted to be positioned alongside the container.

Coating Composition

U. S. Patent 2,809,119. *Oct.* 8, 1957. *D. K. Lesser, assignor to Hercules Powder Co.*

As a new composition of matter, an improved coating composition consisting essentially of a lacquer-in-water dispersion of visibly discrete colored lacquer particles in an aqueous dispersing medium containing from about 0.1% to about 3% by weight of water-soluble lower alkyl cellulose ether as a suspension stabilizer, said aqueous dispersing medium having a viscosity from about 10 cps. to about 5,000 cps., said colored lacquer consisting essentially of from about 20% to about 50% by weight of organosoluble coating material other than nitro-cellulose at least partially miscible with nitrocellulose, a small amount from about 1% to about 10% by weight of nitrocellulose sufficient to materially increase the stability of the coating composition, and volatile organic solvent.

Oxalate Coating

U. S. Patent 2,809,138. *Oct.* 8, 1957. *E. Wagner and A. Moeller, assignors to Farbwerke Hoechst Aktiengesellschaft vormals Meister Lucius & Brüning.*

A bath liquor for treating metal surfaces in order to prepare surface layers, said liquor consisting essentially of an aqueous solution of oxalic acid anions in an amount ranging from about 0.5 gram to about 140 grams per liter, and an amount ranging from about 0.025 gram to about 5 grams per liter of at least one soluble compound selected from the group consisting of xanthates, dithiophosphoric acid esters of the aliphatic series, dithiophosphoric acid esters of the aromatic series, thioglycolic acid, and thiourea, said aqueous solution having an acidity corresponding to a pH value in the range from about 1.0 to about 2.4.

Iron Bath

U. S. Patent 2,809,156. *Oct.* 8, 1957. *W. H. Safranek, assignor to Rockwell Spring & Axle Co.*

The process of electrodepositing a plating selected from the group consisting of iron and iron base alloys which comprises electrolyzing an aqueous solution containing predominantly ferrous sulfate, a minor amount of an organic compound selected from the group consisting of saccharin and phthalimide and a small quantity of a wetting agent, said amount and quantity being sufficient to provide a level and ductile plate.

Electrostatic Coating

U. S. Patent 2,809,902. *Oct.* 15, 1957. *E. M. Ransburg, assignor to Ransburg Electro-Coating Corp.*

A method for electrostatically coating an article, comprising providing a spray of coating material in a pattern which in a plane substantially normal to the general line of movement of spray particles, is an annular band; providing a second spray of coating material in a different pattern which supplements the first pattern to provide a substantially uniform distribution of coating material particles in said plane; and establishing an electrical potential difference between said spray particles and the article to be coated.

Phosphating Compositions

U. S. Patent 2,809,906. *Oct.* 15, 1957. *H. J. Baecker, E. J. Kubis, A. Park and A. W. Liger, assignors to Wyandotte Chemicals Corp.*

In phosphating-cleaner compositions consisting essentially of phosphate salt and organic detergent, the improvement wherein at least 50% by weight of said detergent consists of a conjugated polyoxypropylene - polyoxyethylene compound having the formula

$$Y[(C_3H_6O)_y(C_2H_4O)_zH]_x$$

wherein Y is the residue of an organic compound containing therein x hydrogen atoms capable of reacting with 1,2-propylene oxide, x is an integer greater than one, y has a value such that the molecular weight of the compound, exclusive of the oxyethylene groups, is at least 900, and z has a value such that the oxyethylene groups constitute about 10-90% of the total weight of the compound.

Vitreous Enameling

U. S. Patent 2,809,907. *Oct.* 15, 1957. *M. J. Cramer, assignor to Parker Rust Proof Co.*

A method of forming a vitreous enamel base stock which comprises the steps of forming a metallic phosphate coating on the surface of a metal, the PO_4 portion of said coating having a weight not exceeding about 212 mg. /sq. ft., and heating the said phosphate coated metal in an oxidizing atmosphere at a temperature and for a time sufficient to produce on said metal a combination blue-black phosphate-oxide coating having a total weight not exceeding 42 grams/sq. ft.

Tumbling Barrel

U. S. Patent 2,809,473. *Oct.* 15, 1957. *W. G. Heaphy, assignor to Concrete Grinding Corp.*

Apparatus for smoothing the surfaces of articles comprising a tumbling barrel mounted for rotation on a pair of horizontal trunnions, one of which is hollow, and a vibrator unit mounted in said hollow trunnion and adapted to vibrate said tumbling barrel when charged with said articles, said hollow trunnion including means for expanding and contracting the sides of said trunnion surrounding said vibrator unit, thereby to vary the amplitude of vibration of said vibrator unit.

Copper Anode

U. S. Patent 2,809,929. *Oct.* 15, 1957. *B. D. Ostrow and F. I. Nobel.*

A method of electrolytically depositing copper from an alkaline cyanide copper bath which comprises use of an anode of substantially pure copper containing only the small amount of impurities normally present in commercial refined copper, said anode having incorporated therein a metal taken from the class consisting of nickel, cobalt and iron in amount from about .05% to 1.5% based on said copper.

Spray Painting System

U. S. Patent 2,810,336. *Oct.* 22, 1957. *J. W. Sheffer and E. A. Watson, assignors to ACF Industries, Inc.*

A system for spray painting the exterior surfaces of railway cars.

ABSTRACTS

Repair of Worn Motor Parts with Chromium

A. W. Rykowa: *Report of Moscow Tech. Inst.* (1956).

The Institute obtained the following broad data on hard chromium plating for these applications:

(1) Changes in plating conditions and thickness of the chromium coating showed only small differences in the mechanical strength of the normal and of the chromium-plated test parts.

(2) The hard chromium-plated deposits which were obtained at 30 amp./sq. dm. and 55°C., and at 120 amp./sq. dm. and 65°C. in plating baths with 250 g./l. chromic acid showed a certain reduction of the proportional limit and of the mechanical strength.

(3) It was found that all the hard chromium plating processes change the plastic characteristics of the metal part considerably. It can be assumed that this is caused either by the tensile stresses which are formed during the plating or by the hydrogen gas which is absorbed by the steel.

(4) With all the chromium plating conditions investigated, the coatings showed good adhesion to the basis metal during tensile and bend tests.

(5) A certain scaling-off of the chromium deposits which were obtained at 50 amp./sq. dm. and 55°C. can be explained by the brittleness of the chromium.

(6) Heating of a test part with a 0.2 mm. coating to 700°C. with subsequent rapid cooling in water, served to confirm the good adhesion.

(7) Slight changes of the yield point and tensile strength, which were established during the tests, lie inside the limits of error.

(8) Chromium coatings which were produced at 35 amp./sq. dm. and 65°C., to all intents and purposes do not change the mechanical characteristics.

(9) The elongation is greatly reduced with a coating thickness of 0.05 mm. (circular-shaped cross-section). With a greater thickness, except for small differences depending on the plating conditions, it remains practically unchanged.

(10) The constriction in the tensile test changes with varying plating conditions and it is reduced all the more, the thicker the coating.

(11) The hardness of the coating measured with the Chruschtschow test apparatus, confirmed previously published data.

(12) For all the plating conditions, the bend test shows a decrease of basis metal strength with increasing thickness of chromium coating.

(13) Adhesion of the coating was very high for all plating conditions investigated.

(14) The micro-geometric surface form of the ground chromium plated test part was no different from that of the ground unplated part.

(15) On the basis of the investigations of hard and decorative chromium plated test parts, it must be assumed that the repairing and putting back into service of motor vehicle parts with restoration to the original dimensions, can be achieved with the following chrome plating conditions:

(a) 30 amp./sq. dm. and 55°C.
(b) 35 amp./sq. dm. and 65°C.
(c) 120 amp./sq. dm. and 65°C.

With a current density of 50 amp./sq. dm. and a bath temperature of 55°C., brittle coatings are formed with thicker coatings.

Significance of Barrel Polishing in the Surface Treatment of Metals

M. Dreher: *Metall.* Vol. 11, No. 9, p. 752.

It can be assumed that practically all the commercially used metals and their alloys can be barrel polished. An exception is provided perhaps by certain exceptionally soft metals such as indium, for example, but whose application is relatively limited. Even tin, in the form of centrifugal castings, can be usefully polished in this manner.

Regarding the commercial aspect of barrel polishing techniques, the following can be said. Where small component parts are being produced and a good appearance is required, then this type polishing can be introduced. The great commercial advantage of the process resides in the fact that the parts need not be handled individually but can be treated in bulk. Thus, a considerable saving in expense is obtained at the polishing stage. The term "small parts" is rather elastic. There is no limit to the lower dimensions of parts which can be handled and, in the upper range, parts of 10″-12″ in length can be handled without question. The shape of the ware to be polished does, however, have a considerable bearing on the matter.

As the method of working is in a circular or similar path, and the polishing bodies are round or rounded, it is fairly obvious that round or rounded parts are best handled in this manner. It is also obvious, however, that good results can be achieved with other shapes. The greater the surface however, the worse is the polishing effect with barrel polishing procedure. Parts formed from sheet or wire are best polished by this process. No very great influence is exerted by the alloy composition.

A great role is exerted by the method of manufacture of the components in the case of cast parts. It is best not to treat injection or pressure die-cast parts in this manner. Cast parts frequently show surface unevenness after barrel polishing. This may be due partly to pores or concealed cavities in the metal or else to inclusions in a coarsely crystalline structure. As cast parts are never so homogeneous as regards their crystal structure as are pressed and shaped parts which have been given a strong deformation, more care must be taken when handling the cast parts and even a preliminary small scale test run. In many cases however, barrel polishing will be found to be suitable with cast parts as well.

Research on Salt Spray Test Corrosion—Influence of the Test Part Shape

G. Bianchi and U. Gandolfi: *Metallurgia Italiana.* Vol. 47, No. 12, p. 551.

The authors used a salt spray test chamber, in the upper part of which a salt solution was parabolically atomized by means of compressed air. In this way, the salt spray mist formed made its exit at the central point of the chamber floor after a circular movement around the test parts placed in the chamber. Steel and zinc strips were used as the test parts, being 1 mm. in thickness, 17.5 mm. wide and 200 mm. in length. These test strips

were exposed at 75°C. in various positions.

The solutions for the salt spray test comprised 3 to 20% sodium chloride, adjusted to pH 5, the solutions being buffered with various substances. It was found that the concentration of the salt spray test solution had little influence on the corrosion of iron and steel. The concentration influence was noticeable, however, in the case of zinc and it was found that the corrosion was, in fact, directly proportional to the sodium chloride concentration in the test solution. With the corrosion of the zinc there was observed a partial passivation of the lower part of the vertical test parts.

The authors concluded from the results that additions of ammonium chloride or of 0.5 M boric acid to the sodium chloride solution increases the passivation and the influence of the shape of the test parts, while with 0.2 M boric acid this influence is still present. On buffering with sodium citrate, corrosion products occurred at the lower edge zones of the zinc; with acetate buffering, corrosion products occurred over the whole surface area of the test parts, so that the influence of the shape is only normal in the latter case. In the case of iron and with acetate or M boric acid buffering, the influence of the shape of the test part is in the inverse sense, i.e. the strongest corrosion took place at the vertically placed test parts. With citrate buffering, the corrosion runs normal and is not influenced by the shape of the test part.

Applications of Electrotinned Steel Sheet

W. R. Lewis: *Werkstoffe und Korrosion*. Vol. 8, Nos. 8/9, p. 456.

The properties of electroplated tin sheet are of extreme importance to its application, which is mainly for the production of food can packs. The solderability of the tinplate is of great significance, since the speed and completeness with which soft solder penetrates between the surfaces of electroplated tin sheet is decisive for high speed production. Laboratory tests on solderability clearly show that soft solder does not spread so well with electroplated tin sheet and does not penetrate so well at the soldering positions. The use of highly acid fluxes is not advisable for electrolytic tinplate.

The danger of rusting is considerably greater with the normal thin plated coatings than with hot dip tinplate. The reason is the greater access of the iron to moisture and oxygen. The SO_2 test developed in the laboratories of the Tin Research Institute clearly shows the superiority of hot-dip tinplate. Practice has shown that electrolytic tinplate with 5.6 and 11.2 g./sq. m. tin coating has only a relatively short service life compared with hot-dip tinplate as soon as it is exposed to moist saturated air or to conditions where dew formation can occur.

The corrosion phenomena which occur on the inside of food can packs, when filled, are very complicated. The application of a lacquer coating to the inside of the can, serves to suppress undue corrosion. In practice however, the lacquer coating itself always has pores. Also, during processing, it can become damaged. Covering the metal with lacquer, however, does reduce the tin surface which is in direct contact with a corrosive solution, to a very great extent. The lacquer can also promote pitting corrosion, at pore locations which have no lacquer coating. To overcome some of these difficulties, for certain types of food can packs which are filled with corrosive substances, both types of tinplate can be combined with advantage. For example, the top of the can consists of lacquered electrolytic tinplate and the body of non-lacquered, hot-dip tinplate. The reverse combination is also used. This combination is used with the best results, for a varying pack of not too greatly corrosive materials. The new differentially coated tinplate is being produced in increasing amount.

Prevention of "Tear" Formation with Hot Dip Tin Coatings

C. Chevalier: *Zinn und seine Verwendung* (Duesseldorf). No. 38, p. 4 (1957).

Tear or streaky run formations are the chief defects encountered in hot dip tinning. The author does not enter into great detail regarding the causes of this defect but confines himself to showing how these faults can be prevented. It is of importance that the surface to be tinned, is oxidized. Three processes for the oxidation were considered in detail and showed the following result:

1. Burning or annealing at a dull red heat. This process is not applicable in every case because the metal ware annealed and, consequently, is made soft. In addition, the character of the metal surface is changed and a precise temperature control is necessary. On the other hand, the danger of tear formation is practically always entirely removed by the annealing treatment.

2. Oxidation in air. This method, which should be conducted subsequent to the degreasing and the pickling, gives uniformly good results. However, a large amount of ware is immobilized for several days, depending on weather conditions. A further disadvantage is that the surface condition of parts of the article often becomes changed markedly by too long an oxidation. The oxidation, unfortunately, can only be conducted so that the whole surface is attacked. The process requires, in addition, a great deal of time and, accordingly, is difficult to fit into modern production schedules.

3. Pickling with nitric acid. This process is universally known but it is applied all too seldom because it is believed that the action is too strong. This, however, is not always a disadvantage. In order to obtain uniform results, it is necessary: (a) To thoroughly degrease the article to be tinned and, in particular, to remove all traces of scale and oxides before pickling with nitric acid; (b) To precisely control the pickling time and (c) To control with exactitude the effectiveness of the nitric acid pickle.

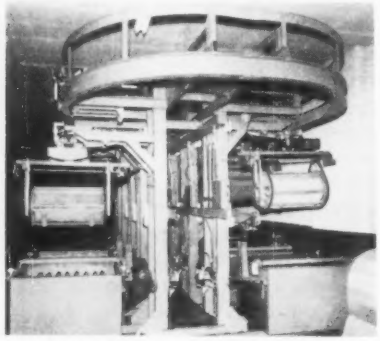
Between a few seconds and 2 minutes is given as a suitable pickling time. Effective control should be conducted by means of a time-switch control. The effectiveness of the acid pickle depends on the concentration and the temperature. If the 36° commercial acid is used, pickling is conducted at a temperature of 15-20°C. As the acid warms up during the pickling process, suitable cooling arrangements should be provided for the bath. The effectiveness of the acid is controlled by measurement of the voltage between a sheet of stainless or carbon steel dipped in the acid and an aluminum sheet. The bath is effective only between the voltage range of 0.5-0.8 volts.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Automatic Barrel Processing Machine

Abbey Process Automation, Inc., Dept. MF, 37-01 48th Ave., Long Island City 1, N. Y.



Designed for high-production processing and job-type multiple operations, ABBEY-Matic completes all cycles with uninterrupted continuity from loading to unloading, accurately and automatically over its overhead trackway—by remote control. The system adapts to any premises and floor plan, utilizes existing tank line equipment, integrates with power and free conveying system for rapid transfer. It provides for carrier accumulation, periodic feeding and loading; then after processing, conveys to any location for unloading, reloading, and return to processing. Furthermore, individual cycling can be varied in any way at any time. Eliminated are all manual operations and auxiliary equipment.

The key to this flexibility is in the principle of "missing link" substitute track segments replacing main track segments which lower with carriers into process-stations. This system permits carriers to "leap-frog" occupied process stations, and "by-pass" wrong stations; while positioning themselves progressively over the right stations and immersing the work in variable predetermined sequences or cycles, automatically. Over processing sections, carriers are operated by a reciprocating overhead transfer and stop device which positions their free-wheeled trucks along an overhead trackway. Each carrier is lowered for immersion at proper station by an individually powered and controlled station-elevator. Elevator disengages main track segment which lowers carrier for work immersion, and replaces it with "missing link" segment, over which other carrier-trucks continue in transit unimpeded. Hence cycle selections are practically limitless.

In cell processing, where several stations are used for high production, carriers enter only one cell of an identical process station, and automatically by-pass the others, in any sequence. Movements and timing are predetermined and actuated by simple, fail-proof electro-mechanical devices. Carriers can be selected and transferred at random for any station. Processing time for different work loads is allotted individually and can be varied from station-to-station by individual timer controls. First of its kind is the non-synchronized carrier and station impulse-memory signaling and control which makes possible this flexible "Multi-Cycle Selection."

The unit is steel fabricated in interchangeable sections by single-station units. Sections are self-leveling for rough floors and not anchored so that systems can be extended or reduced simply by adding or removing stations as desired. Components and parts are standard for convenience and economy in maintenance, interchangeability, and replacement. The system ties-in perfectly with other standard plant conveyor systems.

60/Circle on Readers' Service Card

Test Kits for Chromium Plating Additive

Kocour Co., Dept. MF, 4800 So. St. Louis St., Chicago 32, Ill.

Two simplified analytical test kits have been developed for Diamond CPA-1800 chromium plating additive.

Model CPA kit, used for determining the concentration of CPA-1800 only in chromium plating baths, contains solutions to make approximately 25 tests and includes a standard chromic acid—CPA-1800 solution for checking the end point. Model CPA-CA is a combination kit used for determining concentration of both CPA-1800 and chromic acid.

61/Circle on Readers' Service Card

Multi-Color Lacquer

The Lowe Brothers Co., Dept. MF, Dayton, Ohio.

Surface defects are minimized with this versatile, sturdy finish that dries in minutes. Multi-Tex can be used on almost any surface and withstands repeated washing and scrubbing.

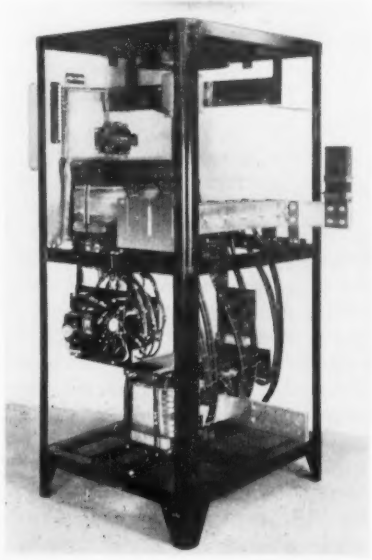
For industrial finishing, its capabilities are as varied as its pleasing color effects. Highly economical, it can be applied to wood, metal and composition surfaces.

62/Circle on Readers' Service Card

Silicon Rectifier

The Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

By utilizing the element silicon as a current converter, the above manufac-



Sel-Rex®

Plating Progress

Sel-Rex®

Published by SEL-REX CORPORATION

APRIL 1958 NUTLEY 10, NEW JERSEY No. 2

Miss Shirley Temple watches "hair growing" on Ideal doll's head.

Ideal Toy Increases Electroforming Production With Sel-Rex Filter to Clarify Critical Solutions

To produce the life-like quality for which their famous Shirley Temple Dolls are noted, Ideal Toy Company usually electroforms masks for doll faces, arms, legs and torsos. Whether you electroform doll molds, record masters, or critical guided missile components, proper filtration is an absolute must. That's why Ideal, like hundreds of other electroformers and platers, specify a Sel-Rex Filter.

In other words, quality first. If you can maintain the quality customers demand and increase production at the same time . . . why not? Ideal Toy did it. "... our Sel-Rex Filter has helped us increase production appreciably." states Mr. A. R. Miller, Chief Chemist. And since this firm operates in a fiercely competitive industry, almost any advantage becomes a competitive edge which adds to profits.

If your manufacturing operation entails liquid clarification or solids recovery a Sel-Rex Filter may help to increase your profits. Standard models range from 250 to 18,000 gallons per hour capacities, and feature stainless steel mesh elements, interchangeable with a porous stone. Our 12-page literature gives details on other profit-increasing features. Ask for #F-6.

FREE LITERATURE CORNER

Just Off The Press . . .

- ☐ PR-1 • Completely new "Guide" to Plating Rectifiers—20 pages, illustrated
- ☐ RX-2 • Rhodium Electroplating Processes—12 pages, demonstrations & charts
- ☐ JP-1 • Jet Plater — Technical Data Bulletin.
- ☐ AC-4 • CuSol Acid Copper Process, tree-free heavy deposits—technical report

Still Available . . .

- ☐ BR-a • Gold Plating, Industrial & Decorative, by E. C. Rinker—8 pages, illustrated
- ☐ FD-b • Gold Plating in Electronics by Federal Telephone & Radio—4 pages, illustrated
- ☐ F-6 • Electroplating Solution Filter—12 pages illustrated, technical data.

NOTE: For your convenience, when requesting the literature you want, simply refer to it by the prefixed code.

Double Thick Rhodium Plate

Rhodium electroplate of at least twice the thickness possible with conventional Rhodium formulations is being obtained with Sel-Rex Rhodex, the only Rhodium process which yields compressively-stressed deposits. Reports from government agencies and private industry indicate that Rhodex electroplate in thicknesses exceeding one-thousandth-of-an-inch are commonplace. Ordinary Rhodium plate generally fractures and fails at half that thickness.

A 24-page brochure tells you all about plating with Rhodium. Ask for #RX-2.

Low Cost Precious Metals Plating With Portable Automatic Machine

How to plate with precious metals, do a quality job, and still cut costs substantially, has been demonstrated by Wallace & Tiernan Co., Inc., Belleville, New Jersey. According to actual production records, a Sel-Rex Jet Plater *saved 932 hours on the first two jobs.* This entailed Gold plating flasher and lamp changing components used in Wallace & Tiernan Aids to Navigation equipment.

The totally new Jet Plater is a complete electroplating plant in a streamlined cabinet measuring only 34" x 28" x 33" high. Several new models permit either rack or barrel plating with any cold alkaline solution and most of the usual acid solutions. Quality plating at high speed is possible through the ideal system of a pump and jet orifice manifold at the bottom of the plating tank. Constant swirling of the solution around the work assures smooth, even deposits at higher speeds than possible through mechanical agitation methods.

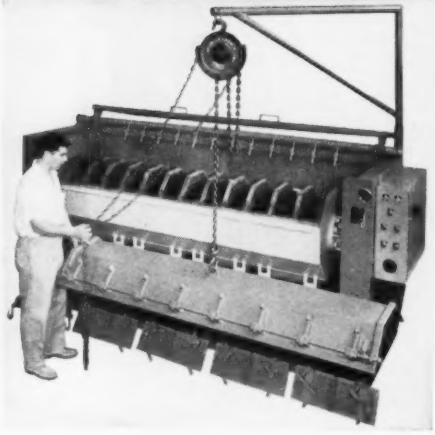
Completely automatic in operation, the Jet Plater features a panel board containing dual scale ammeter, powerstat control for rectifier, circuit breakers, and automatic timer which sounds alarm upon completion of the plating cycle. Bulletin JP-1 gives complete details and specifications, including the wide range of recommended plating solutions.

BIG VOLUME BARREL FINISHING with THE ABBOTT METHOD

Big volume — low operating costs are features of this twelve compartment barrel engineered by Abbott.

Abbott's high, narrow design concentrates tumbling pressures — speeds finishing operations. Combined with Abbott's scientifically designed steel balls and shapes they produce the famous Abbott Method of barrel finishing.

Abbott barrels are tailored to fit your particular needs. Ask about 'em today.



ABBOTT CARBON STEEL BURNISHING & DEBURRING SHAPES

Shape	Size Range	Shape	Size Range
Abco BALLS	3/32" thru 3/4"	DIAGONALS	1/16" thru 1/4"
Eclipse BALLS	3/32" thru 3/4"	PINS	1/16" x 3/32"
OVALBALLS	1/8" thru 3/8"		1/16" x 1/2"
BALLCONES	1/8" thru 5/16"		1/8" x 3/8"
CONES	1/8" thru 1/2"	PEBS	1/32" and 1/16"

the abbot

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THE ABBOTT BALL COMPANY

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turer's electrical engineers claim practically no loss of efficiency no matter how long the machine is in use. A new and revolutionary "balanced" circuit control assures the rectifier a uniform output of power.

It can be delivered in a variety of ampere and voltage ratings.

65/Circle on Readers' Service Card

Addition Agent for Cyanide Copper Baths

Wagner Bros., Inc., Dept. MF, 400 Midland, Detroit, Mich.

A new addition agent for copper plating is designed to act as a grain refiner in producing dense copper deposits. An alkaline material, soluble in a cyanide solution, the agent is said to provide soft, ductile deposits which can be used as a stop-off for selective hardening in heat treating operations, or as a smooth buffable copper. It can be used in both barrel and rack-type operations.

Produced in the form of a yellow liquid, the development, referred to as CU-521, is reported to have good throwing power, and can be plated at current densities up to 50 amp./ft.^{2} without roughness or burning. When operated at 100 per cent efficiency and increased copper metal content, it is capable of producing bright out-of-the-bath copper deposits with current densities up to 25 amp./ft.^{2}

The material is partly lost during electrolysis, but mostly through drag-out. However, the addition of 3 cc per gallon to the electrolyte each 8-hour shift is sufficient to maintain uniform color, and the bath in good operating order.

66/Circle on Readers' Service Card

High Current Ammeter

Rapid Electric Co., Dept. MF, 2881 Middletown Road, New York 61, N. Y.

This d.c. current transducer consists of a widow-type a.c. current transformer through which the d.c. bus bar or cable is passed. Current ranges vary from 500 to 500,000 amperes with an accuracy of .5% to 1%. The transducer is furnished complete with isolation transformer (T-1) a.c. current transformer (T-2) selenium rectifier (RC), meter instrument (M-1), pilot light (P-1), and on-off switch (S-1). All items, with the exception of the a.c. current transformer are housed in a metal cabinet measuring 8" high x 14" wide x 8" deep.

The a.c. current transformer consists of two saturable core reactors which are magnetically coupled to the d.c. bus. This transformer produces an a.c. signal that is linearly proportional to the magnitude of the d.c. in the bus bar. Since d.c. power (bus power) cannot be transmitted across a magnetic circuit, separate excitation voltage is supplied to the secondary by the isolation transformer. The a.c. secondary circuit is then rectified by the selenium rectifier and measured by the meter instrument.

67/Circle on Readers' Service Card

Transparent Polyvinyl Chloride

Kaykor Industries Div., Kaye-Tex Mfg. Corp., Yardville, N. J.

A new material for applications demanding both corrosion resistance and light transmission is expected to prove particularly useful in the manufacture of such equipment as small plating tanks. It is stated to be the first transparent vinyl plate ever available that

offers the same wide range chemical resistance and tough physical character as the conventional opaque unplasticized polyvinyl chloride.

Available in two tints. Type F-51 is a clear yellow . . . Type F-63 an emerald green. Samples for design and evaluation are available on request.

68/Circle on Readers' Service Card

Protective Bright Dip for Cadmium

Allied Research Products, Inc., Dept. MF, 4004-06 E. Monument St., Baltimore 5, Md.

Iridite 4P-4 is a powder which permits a single dip process for chemically brightening and protecting cadmium plated surfaces. It requires no bleach and produces clear, bright films without stain in either rack or bulk work. It rinses easily, thus making for quick processing cycles and has good corrosion protection in addition to producing a high degree of chemical polish.

This new product retains its brightness and good solderability on cadmium plate even after long periods of storage. It is low in make-up cost and gives excellent mileage, thus making it economical to use, and requires no additions other than the single powdered compound, which simplifies maintenance and control. The material is packaged in 100 lb. drums.

69/Circle on Readers' Service Card

Portable Plating Unit

Sel-Rex Corporation, Dept. MF, Nutley, N. J.

A compact unit measuring only 34" x 28" x 33" contains all the equipment and features for precision-plating of electrical or electronic parts, specification precious metals plating, or "pilot plant" set-ups. A completely redesigned version of this firm's Jet Plater, the new models are said to permit either barrel or rack plating with any cold alkaline solution, and most acid plating solutions, on a mass-production basis.

The new units provide a stainless steel, canned turbine pump, in conjunction with a vinyl, jet orifice manifold at the bottom of the plating tank. In operation, the solution is continuously drawn off from the bottom of the tank, circulated through the pump and built-in filter, and returned to the tank under pressure.

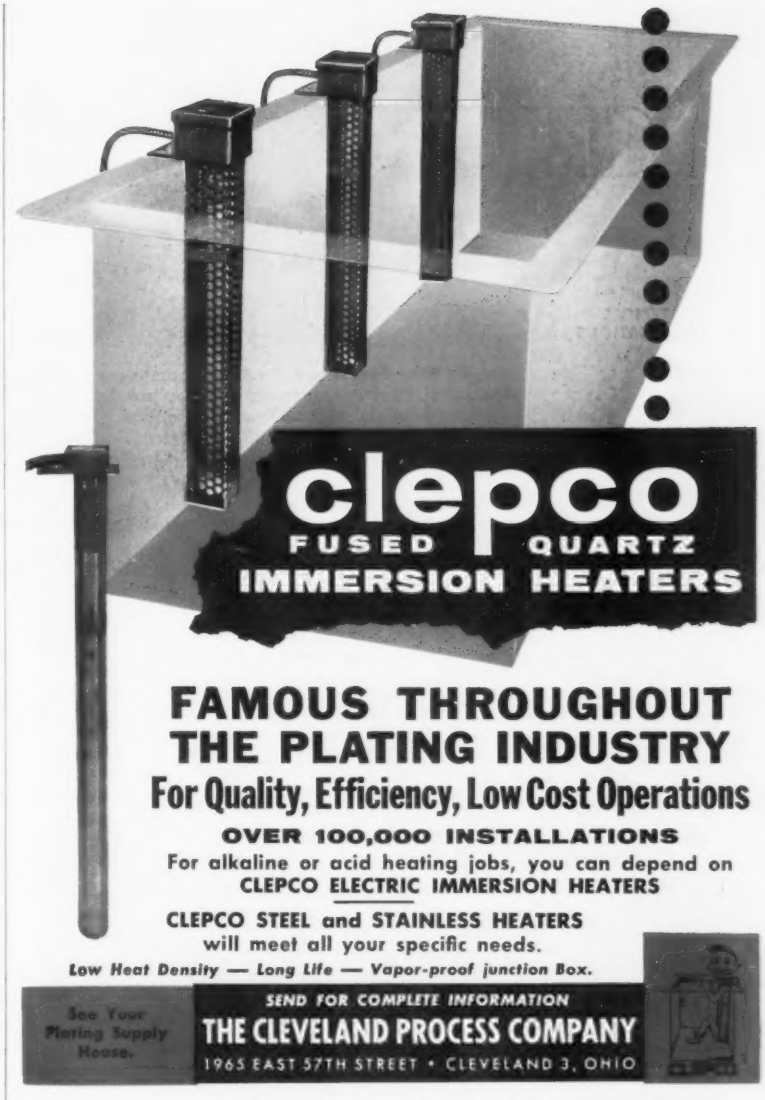
It is reported that the units are completely automatic, all operations being controlled from convenient panel board which incorporates dual scale ammeter, powerstat control for rectifier, circuit breakers, and automatic timer which sounds alarm upon completion of plating cycle.

71/Circle on Readers' Service Card

Airless Paint Spray Unit

Spee-Flo Co., Dept. MF, 720 Polk, Houston, Tex.

A new airless paint spray model, based on hydraulic atomization, is compact and portable, and offers the advantage of almost complete elimination of overspray, making it possible to spray in open areas without conventional spray booths, and resulting in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FUSED QUARTZ
IMMERSION HEATERS
FAMOUS THROUGHOUT
THE PLATING INDUSTRY
For Quality, Efficiency, Low Cost Operations
OVER 100,000 INSTALLATIONS
For alkaline or acid heating jobs, you can depend on
CLEPCO ELECTRIC IMMERSION HEATERS
CLEPCO STEEL and STAINLESS HEATERS
will meet all your specific needs.
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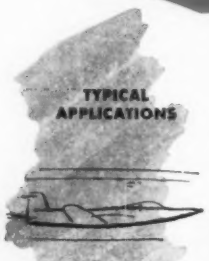
look at these advantages of

IRIDITE® FINISHES

for

CORROSION-RESISTANCE, PAINT BASE on ALUMINUM and MAGNESIUM

TYPICAL APPLICATIONS



Aircraft and Missile Parts

Automobile Hardware

Outdoor Furniture

Communications Equipment

Marine Equipment

EASE OF USE—Iridite is a simple chromate conversion treatment. Fast, easy, economical. You just dip, brush or spray it on the part at room temperature. No special equipment. No specially trained personnel.

OUTSTANDING PERFORMANCE—Forms a film that is an integral part of the metal itself. Can't flake, chip or peel. Takes paint firmly on initial application, and the bond lasts. Even protects areas scratched in use.

LOWEST COST—You have only minimum equipment cost, no special racks, high speed operation, lower overall handling costs.

CHOICE OF APPEARANCE—Clear coatings that retain metallic lustre to dark, maximum protection coatings. A variety of colors is available by dyeing.

IRIDITE #14 and #14-2 (Al-Coat) for ALUMINUM

Two specially formulated finishes that give you maximum latitude in aluminum treatment. Both provide excellent corrosion protection and paint base. Iridite #14-2 is an improved product that allows greater flexibility in operation and coating thickness and produces the optimum in corrosion protection.
Either coating provides corrosion resistance superior even to complicated electrolytic treatments in a fraction of the time. These coatings also offer many other valuable characteristics: they have low electrical resistance, they aid in arc-welding, provide a good base for bonding compounds, have no effect on the dimensional stability of close-tolerance parts. Final appearances ranging from clear through yellow iridescence to full brown can be obtained. By dyeing, you can produce red, green, blue, orange or yellow finishes.

IRIDITE #15 for MAGNESIUM

Produces a protective, paint base film with corrosion resistance at least equal to that obtained from long, high-temperature dichromate treatments in a fraction of the time and at room temperature. The appearance of the coating can be varied from light brown to dark brown and black.

APPROVED UNDER GOVERNMENT AND INDUSTRIAL SPECIFICATIONS

SEE FOR YOURSELF WHAT IRIDITE CAN DO . . . SEND SAMPLE PARTS FOR FREE PROCESSING. Look at the results, test the protection, evaluate the savings. Also write for handy Reference File of the most complete data published on chromate conversion coatings. Or, for immediate information, call your Allied Field Engineer. He's listed under "Plating Supplies" in your classified phone book.

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Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals.
West Coast Licensee—L. H. Butcher Co.

material savings of up to 40%.

In the Flexaflo HydraAirless, viscosity-controlled paints are forced through a specially designed orifice at high pressure, achieving the desired atomization through control of pressure, viscosity and orifice. It consists of a controller and explosion-proof heated hose assembly. The controller raises the temperature of the material to the desired level, while the flexible heaters within the hose maintains the temperature until it reaches the gun.

Materials are supplied by a simple, reciprocating pump, operating from the original five or fifty-five gallon container. The air operated pump uses less than one cubic foot per minute and may be served with as little as a quarter horse power compressor.

Moderately priced, the unit is light weight and mobile. The length of hose between pump and controller unit can be as long as necessary to give the user access to almost any area.

73/Circle on Readers' Service Card

Abrasive Finishing Compound

Lord Chemical Corp., Dept. MF, 2068 S. Queen St., York, Pa.

Lorco "3X" was formulated to meet the specific need for a tumbling compound that would provide faster deburring and cutting on non-ferrous metals and alloys. This mild, relatively soft abrasive powder is especially recommended for the softer metals; however, it is also excellent for light deburring or cleaning of harder materials. It is not designed for heavy deburring and stock removal but will reduce micro-inch readings fast. It may be used with any chemically inactive media or in the self tumbling of suitable parts. With harder metals and alloys, or where considerable stock removal is required, it can be used for cleaning

and refining after long cut-down cycles. It is also excellent for the removal of films or skin on die-cast parts and similar workpieces. Low water levels are recommended for most applications.

55/Circle on Readers' Service Card

Stripper for Vacuum Plating Rejects

Octagon Process, Inc., Dept. MF, 29 Bank St., Staten Island 1, N. Y.

A new, extremely fast-acting cold solvent stripper, Octastrip 444, is designed for low-cost stripping of vacuum plating rejects for refinishing.

The material is used for high speed tank immersion stripping on a production line basis. It is claimed to act in 15 seconds to a minute, at room temperature, and loosen even the toughest finishes and vacuum-coated metals. It requires only a pressure water spray to leave the metal surface clean and ready for refinishing.

The stripper is non-inflammable and non-corrosive. It can be safely used in mild steel tanks in an adequately ventilated enclosed area. It is available from stock in standard 55-gallon and 5-gallon drums and in 1-gallon case lots, (6 cans per case).

74/Circle on Readers' Service Card

Wall-Mounting Nozzles

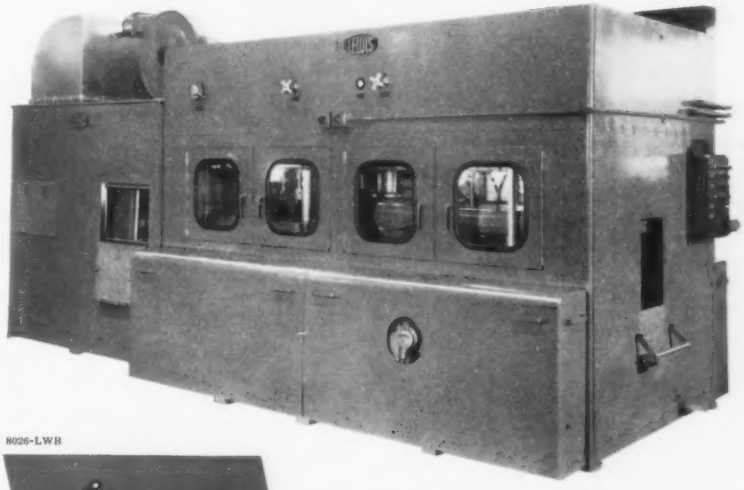
Spraying Systems Co., Dept. MF, 3201 Randolph St., Bellwood, Ill.

Newly designed wall-mounting pneumatic atomizing nozzles, where the body acts as the flange, offer the advantages of fitting any wall thickness and easy, leak-proof installation. To mount the nozzle all that is required is the drilling of one hole for entry of the nozzle cap and the drilling and tapping of four 1/4" holes for fastening screws. When used for spraying into a pressurized chamber, a gasket between the nozzle body and wall seals the closure. Because of this design, the nozzle is suitable for any wall thick-

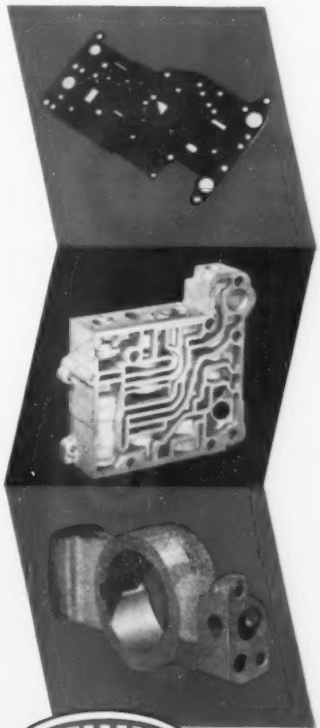
Lewis presents

MICRO BLAST

the FIRST fully automatic metal finishing machine



8026-LWB



new liquid abrasive process produces finishes to 12 R.M.S. on 320 parts per hour

Featuring unique automatic methods . . . special blast-gun design . . . one-man operation . . . machine tool construction, MICRO BLAST machines create substantial cost savings in metal parts finishing. Precision controls and variable abrasive slurry permit a wide range of uniform, microscopically smooth surface finishes in production quantities.

The Type 210 twin-belt design illustrated handles a variety of shapes, including the parts shown at left. All operations, except parts feeding, are automatic. The conveyorized rinse and dry cabinet finishes up to 320 parts per hour.

Lewis MICRO BLAST machines are *custom designed* for versatility and the most efficient handling of finishing problems. Our engineers will help analyze your needs and make specific recommendations.

FOR ADDITIONAL DETAILS, WRITE FOR NEW BULLETIN MB-100 . . . or call BEdford 2-2500.

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Designers • Engineers • Fabricators • Machinists

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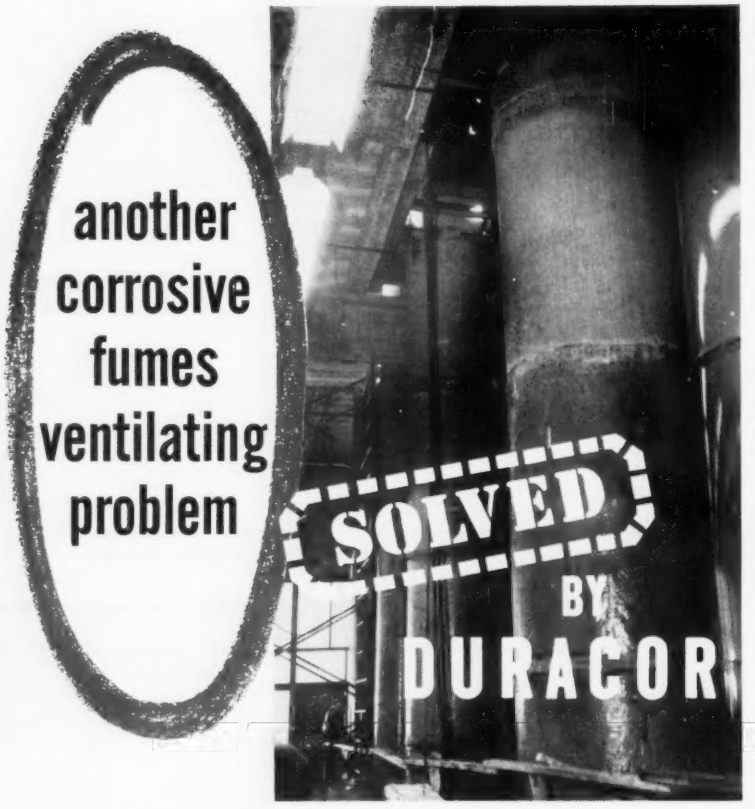
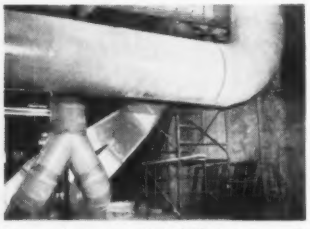
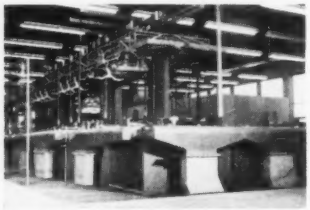


Duracor Ventilation System exhausts 250,000 C.F.M. of corrosive fumes from large electronic equipment plant.



Strong, lightweight DURACOR ducts over 5 feet in diameter require minimum support.



Corrosion-proof throughout, these DURACOR "drops" need no exterior protection from spillage.

Weather and corrosion resistance are provided by DURACOR "T" sections on roof.

PROBLEM: This ventilating system had to withstand sulphuric, nitric, chromic, phosphoric acid and cyanide fumes emitted from the plant's plating and anodizing operation.

SOLUTION: Working from customer specifications, Ceilcote engineers built the entire ventilating system shown here completely from DURACOR.

INSTALLATION: Experienced Ceilcote supervisors and crews handled the complete installation under one contract. Materials and workmanship are fully guaranteed.

WHAT'S YOUR PROBLEM? . . . DURACOR resists any corrosive gas, fume or liquid . . . can be fabricated to virtually any shape. Write today and tell us about your requirements.

DURACOR CEILCOTE

8019-CC

THE CEILCOTE COMPANY, INC.

4844 Ridge Road • Cleveland 9, Ohio

76/Circle on Readers' Service Card

ness and may be transferred and reused with later installations no matter what the new wall thicknesses may be.

These nozzles, identified as the ¼ JDL, are available in all ¼ J air and fluid nozzle set-ups, in a choice of brass or type 303 stainless steel, with rear shut-off needle as shown, with clean-out needle assembly or with plug only.

77/Circle on Readers' Service Card

Multiple-Barrel Finishing Unit

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, Ohio.

Easier handling and flexible capacity for tumbling, deburring and polishing are now obtainable with the Model DLX finishing unit. The 2.2 cu. ft. machine offers two or three compartments and 12 to 36 rpm variable speed drive. The enclosed cabinet provides a built-in reciprocating screen separator and a one cu. ft. hopper pan for fast handling of work-pieces and media. A drainage outlet is provided for connection to existing drains.

Other features include direct chain and sprocket drive, remote controlled magnetic starter, waterproof push button, "no-seam" vinyl-lined barrels, and optional timing accessories. The unit has a ½ hp 220 or 440 volt motor, welded steel plate construction, and overall size 40" x 42" x 49".

78/Circle on Readers' Service Card

Zinc Brighteners

Allied Research Products, Inc., Dept. MF, 4004-06 E. Monument St., Baltimore 5, Md.

ARP 32 is a powdered addition agent which provides brightness over the entire normal plating range found in still and automatic cyanide zinc tanks, and ARP 53 is a low cost liquid addition agent for barrel plating that has

excellent brightening action and stability.

ARP 32 gives an excellent, uniformly bright plate over current densities ranging from the lowest encountered in still plating to as high as 70 amps. It provides fine grained deposits which will bright dip in nitric acid or chromate bright dips. It has excellent throwing power, and gives good coverage and brightness in recesses and in hard-to-reach areas, especially on racked parts. The powdered form is easily dissolved in warm water, and is available in 100 lb. drums.

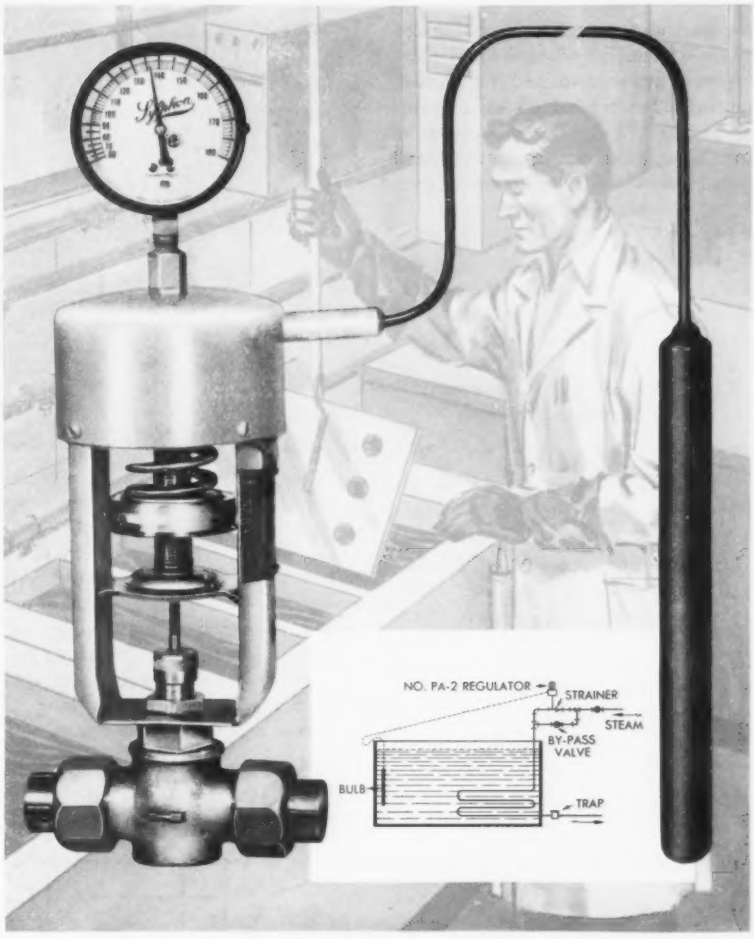
ARP 53 has a wide current density range that provides brightness for barrel plating operations both in recesses and on outside areas. This brightness is of a degree which is usually acceptable even without bright dipping, but has an exceptional clarity and sparkle after bright dipping in either ½% nitric acid or chromate bright dips. It is extremely stable and may be added to conventional cyanide plating solutions already containing other brighteners. Easy to use, its liquid form makes it possible to add brightener directly to the solution without mixing. It is available in 5-gallon pails containing 40 lbs. or in the 1-gallon Auto-Flo-Pak containing 9 lbs.

79/Circle on Readers' Service Card

Coated Work Gloves

Riegel Textile Corp., Dept. MF, 260 Madison Ave., New York 16, N. Y.

A complete new line of coated work gloves has just been introduced. The Neoprene gloves are claimed to be liquid-proof, resist acids, solvents and caustics, and are also recommended



PRECISE TEMPERATURE REGULATION

just MADE for metal finishing

Get better cleaning, plating and coating . . . save materials, steam, labor . . . cut rejects by insuring precise temperature regulation with this Sylphon® No. PA-2 Temperature Regulator. Sturdily constructed for long life in the plating room, this self-operating unit is simple, dependable and easily adjusts for desired temperature. Dial thermometer is large and extra legible. Stainless steel frame and valve trim, and plastisol coated bulb resist corrosion from virtually all metal finishing chemicals. Temperature ranges of 60° to your specifications.

WRITE FOR BULLETIN GT-548

Robertshaw-Fulton CONTROLS COMPANY

FULTON SYLPHON DIVISION · Knoxville 1, Tenn.

80/Circle on Readers' Service Card

wherever heat, snagging or cutting are a danger. The fully-coated vinyl plastic gloves are said to be 3 or 4 times more effective against oil than ordinary plastic gloves. The manufacturer also claims protection against solvents and abrasives, superior finger dexterity, and improved hand comfort.

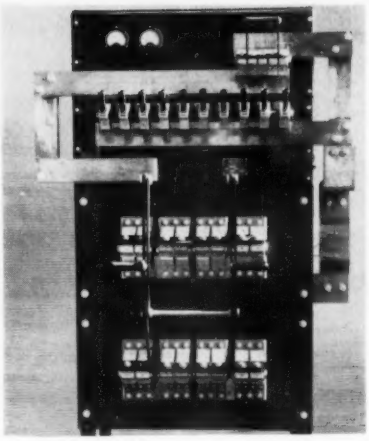
A positive grip, and excellent resistance to cutting, abrasions, heat and punctures are claimed for the natural rubber coated group.

81/Circle on Readers' Service Card

Combination Tank Rheostat and Reversing Switch

Columbia Electric Mfg. Co., Dept. MF, 4519 Hamilton Ave., Cleveland 14, Ohio.

A special panel assembly for plating control 90" high x 30" wide, consists of a combination 3,000 ampere reversing switch and a 2,500 ampere, three volt drop tank rheostat. The tank rheostat has ten switches to give 50 steps of control with increments of 50 amperes, and is equipped with a short circuiting switch. Ammeter and voltmeter are mounted on panel at top.



Construction on both reversing switch and tank rheostat incorporates a unique heavy duty, self-cleaning toggle switch. The cam action of the switch assures position contact pressure, while the moving contacts of laminated copper assure a wiping, self-cleaning action. The rheostats also feature resistors of sturdy cast grid construction known for its long life and resistance to chemical fumes.

82/Circle on Readers' Service Card

Fire Extinguisher

American LaFrance Corp., Dept. MF, Elmira, N. Y.

An improved Foamite ST unit, employing a new protein stabilizer type charge, now produces fire-killing chemical foam which actively resists water discharged from an overhead sprinkler system. The new unit is claimed to eliminate the need for water deflection canopies in industries using dip tanks, drain boards, etc.

83/Circle on Readers' Service Card

Lead Foil Tape

Permacel-LePage's Inc., Dept. MF, New Brunswick, N. J.

A new pressure sensitive lead foil tape is used primarly in electroplating work as a "stop-off" tape to mask off parts which are not to be plated. Designated as EI 3879, the new tape features easy release of its polyethylene liner, which permits convenient, quick application. A specially compounded lead foil combined with a highly pressure sensitive adhesive and the new liner make the tape useful in a number of applications.

SAD SOAK TANK TALE
...WITH A HAPPY ENDING
BILL*, I'VE CALLED YOU IN BECAUSE I'VE GOT TO CUT CLEANING COSTS ON THE ALUMINUM SHEETS, CASTINGS AND EXTRUSIONS WE PREPARE FOR ANODIZING.
OK BY ME, KEN. PUTTING THE AXE TO A CUSTOMER'S COSTS IS A PENNSALT SPECIALTY. WHAT'S YOUR PROBLEM?
*BILL WILSON, PENNSALT REPRESENTATIVE
NOT WHEN YOU USE PENNSALT A-28. IT'S AN ANHYDROUS POWDERED ALKALINE CLEANER THAT'S SPECIALLY INHIBITED TO PREVENT ATTACK ON ALUMINUM. AND A-28 DOES A GREAT JOB OF REMOVING RED AND BLACK MARKING INKS, FINGER MARKS AND SHOP SOILS.
LATER THE SAME WEEK
I WOULDN'T BELIEVE IT IF I HADN'T SEEN IT WITH MY OWN EYES. WE'VE COMPLETELY ELIMINATED HAND WIPING. EVERYBODY HERE IS PLEASED AS PUNCH WITH THE RESULTS.

The long aging adhesive provides for a stable product and the smooth, wrinkle-free backing is sufficiently soft to conform to various configurations. Overall thickness of the new tape is 6.0 mils. Tensile strength (no liner) is 18.0 lbs./in., and elogation is 10-12%. Adhesion to liner 9 oz./in., and adhesion to steel is 32 oz./in.

84/Circle on Readers' Service Card

Compressed Air Filter

Commercial Filters Corp., Dept. MF, 2 Main St., Melrose, Mass.

A new single-tube filter for compressed air is made from nickel-plated brass to eliminate any possibility of iron contamination or rust. 7-inch honeycomb filter tubes provide true depth (not surface) filtration to minimize gumming and remove moisture, oil, microscopic rust, and dirt particles. Flow rates are 50 cfm (free air) at 40 psi; 70 cfm at 80 psi; 76 cfm at 100 psi. Streamlined head with single center bolt provides for speedy servicing. Loosen only one nut to replace element. Filter is supplied with or without mounting bracket for $\frac{3}{8}$ inch or $\frac{3}{4}$ inch pipes. Honeycomb filter tubes are

available in a wide range of controlled densities to provide the exact degree of micro-clarity needed for each operation.

85/Circle on Readers' Service Card

Paint Stripper

Kolene Corp., Dept. MF, 12890 Westwood Ave., Detroit 23, Mich.

A new type low-temperature solution for rapid paint stripping, known as Kol-Strip, was formulated for stripping all types of modern organic finishes, including epons, modified epons and acrylics. Sheet metal panels, cabinets, and other parts which would normally become distorted in higher temperature processes, are being stripped clean in the 260° to 275° solution, without affecting the part in any way.

The product is a non-inflammable, chemically balanced formula. Action is fast and unique, for it not only forces a clean break of the paint bond, but completely dissolves the resins and separates the pigments. The latter settles to form the sludge, which is easily removed, keeping the bath in operating condition.

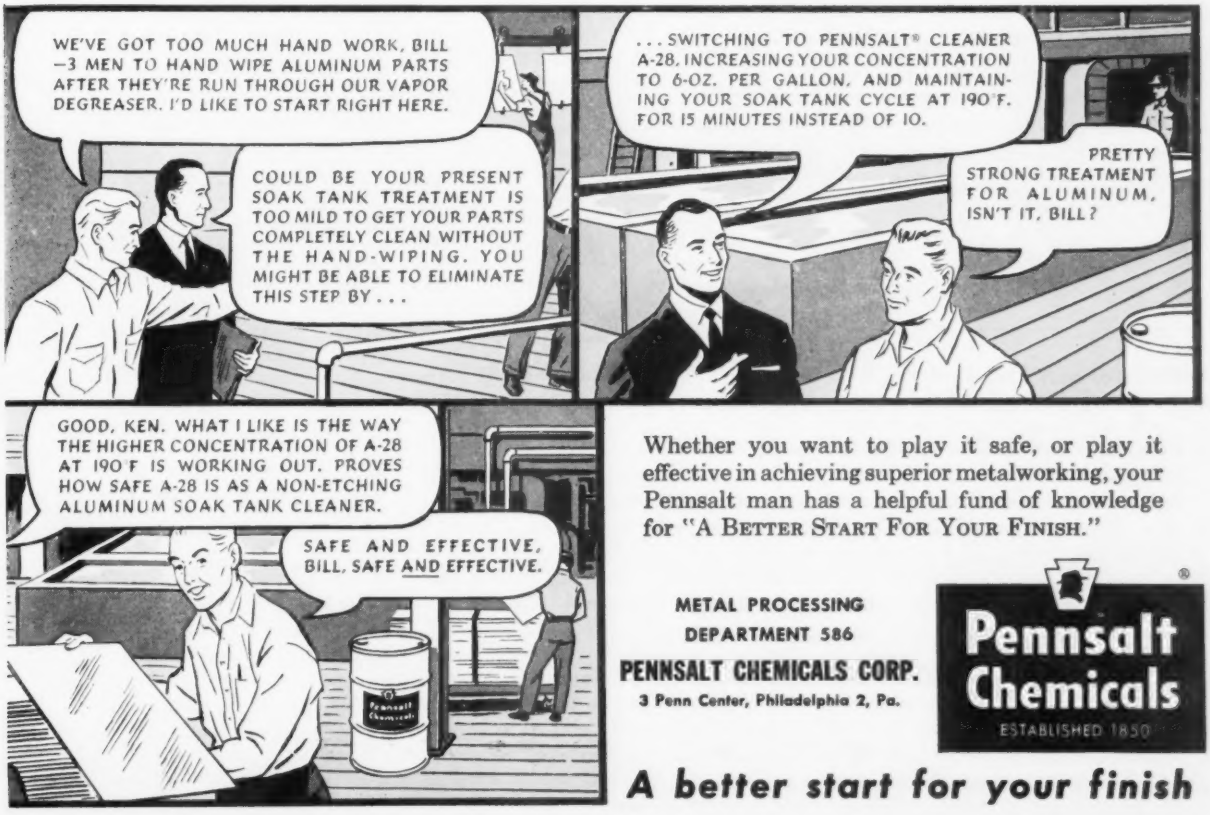
The stripper is said to have long operating life and no complicated analyses are required to determine when additions to the bath are necessary.

86/Circle on Readers' Service Card

Automatic Sunray Machine for Cookware Shells

J. M. Nash Co., Dept. MF, 2366 N. 30th St., Milwaukee 10, Wis.

An automatic machine capable of producing the inside sunray pattern on circular cookware shells, the No.


WE'VE GOT TOO MUCH HAND WORK, BILL —3 MEN TO HAND WIPE ALUMINUM PARTS AFTER THEY'RE RUN THROUGH OUR VAPOR DEGREASER. I'D LIKE TO START RIGHT HERE.
COULD BE YOUR PRESENT SOAK TANK TREATMENT IS TOO MILD TO GET YOUR PARTS COMPLETELY CLEAN WITHOUT THE HAND-WIPING. YOU MIGHT BE ABLE TO ELIMINATE THIS STEP BY . . .
. . . SWITCHING TO PENNSALT® CLEANER A-28, INCREASING YOUR CONCENTRATION TO 6-OZ. PER GALLON, AND MAINTAINING YOUR SOAK TANK CYCLE AT 190°F. FOR 15 MINUTES INSTEAD OF 10.
PRETTY STRONG TREATMENT FOR ALUMINUM, ISN'T IT, BILL?
GOOD, KEN. WHAT I LIKE IS THE WAY THE HIGHER CONCENTRATION OF A-28 AT 190°F IS WORKING OUT. PROVES HOW SAFE A-28 IS AS A NON-ETCHING ALUMINUM SOAK TANK CLEANER.
SAFE AND EFFECTIVE, BILL, SAFE AND EFFECTIVE.

Whether you want to play it safe, or play it effective in achieving superior metalworking, your Pennsalt man has a helpful fund of knowledge for "A Better Start For Your Finish."

METAL PROCESSING
DEPARTMENT 586
PENNSALT CHEMICALS CORP.
3 Penn Center, Philadelphia 2, Pa.

Pennsalt Chemicals
ESTABLISHED 1850

A better start for your finish

87/Circle on Readers' Service Card

99.75+% PURE

Every batch checked. Every can filled with a full weight of extra high quality 99.75+% Chromic Acid. Prompt delivery from ample factory and nearby distributor stocks. Why not order BFC Chromic Acid next time?

BETTER FINISHES & COATINGS, INC.

268 Doremus Avenue, Newark 5, New Jersey

2014 East 15th Street, Los Angeles 21, California

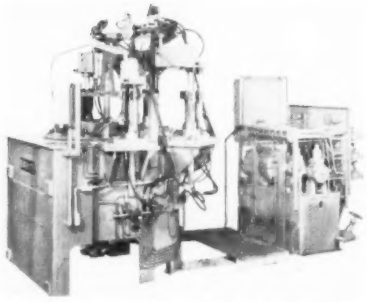
88/Circle on Readers' Service Card

130 Multi-Spindle Sunray Machine will accommodate shells in diameters up to 12″ and a pullout height of 8″. As the operation of creating the inside finish is automatic, it is only necessary for the operator to load and unload the shells.

The unit has an 8-inch spindle turret. These spindles have a variable rate of rotation, revolving only in the working zone, and are stationary when loading and unloading. Cookware shells are held in the spindle chucks by vacuum, making it possible to achieve inside sunray finishing on deep as well as shallow shells.

The machine is equipped with five sunray heads, each carrying an endless abrasive belt which automatically indexes for each shell. The abrasive belt carries over a cushioned pad mounted on a hydraulically cushioned stem, which is the contact point for the sunray action. Abrasive belts also carry through a reservoir for belt cleaning and lubricating.

After the cookware shells are loaded into the vacuum chuck the turret progresses the then revolving shells under the sunray stations. These stations, carrying the abrasive belt, come down directly behind the center of the bottom surface of the shell, starting the sunraying cycle. The revolving shell travels at a controlled rate of speed, thereby creating the sunray pattern on



the bottom surface of the shell. When reaching the corner of the shell, an imperceptible pause takes place, and during this slight dwell the turret stops its forward motion, allowing the sunray heads to pull out and produce a sunray effect on the inside surface of the complete shell. This operation takes place successively on all sunray heads, with selected grits of abrasive utilized to obtain the degree of pattern desired.

The machine is hydraulically operated. In order to secure complete accessibility and easy maintenance, the hydraulic unit is mounted outside the machine, as shown in the accompanying illustration.

89/Circle on Readers' Service Card

Filtration Tanks

American Agile Corp., Dept. MF, P. O. Box 168, Bedford, Ohio.

Industrial filtration tanks, now fabricated from linear polyethylene, are extremely resistant to moisture and corrosive attack.

The units measure 27″ O.D. and are 36″ deep, with a ½″ thick wall of linear polyethylene. The tanks are fitted with linear polyethylene filtration piping of welded and threaded construction.

A welded steel support cradle encloses the tank, and steel lug plates on the cradle are used to position the tank in a process line.

90/Circle on Readers' Service Card

Concrete Bonder

Carboline Co., Dept. MF, 32 Hanley Industrial Court, St. Louis 17, Missouri.

A modified epoxy adhesive, for use in bonding new concrete to old concrete, designated as Concrete Adhesive 192-34, now solves many difficult concrete patching jobs such as the leveling of floors that are badly deteriorated and contain ruts, gullies, holes, etc. This adhesive assures tight bond of the new concrete to the old concrete.

54/Circle on Readers' Service Card

Resistant Coating

EverLube Corp., Dept. MF, 6940 Farmdale Ave., North Hollywood, Calif.

A new corrosion and abrasion resistant coating is claimed to withstand a minimum of 200 hour salt spray per mil film thickness when applied to metals including magnesium. The coating loses none of its abrasion resistance after immersion for 24 hours in distilled water, JP-4 fuel, aromatic test fluid, hydraulic fluid, aircraft lubricating oil, etc. The material retains its abrasion resistance even after extended exposure to 250° F.

At the present time, "Endurskin" is manufactured in black and also aluminum. Special colors are formulated to order.

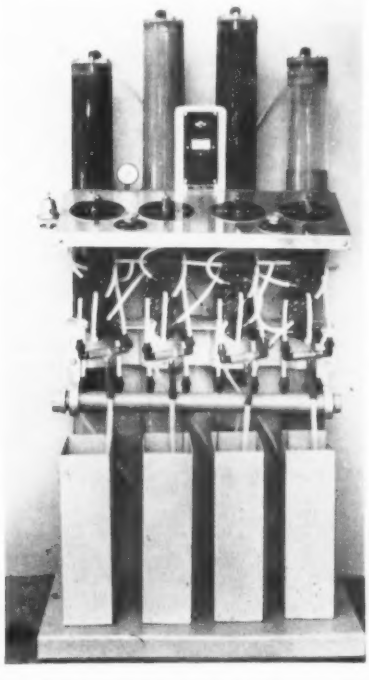
The material may be brushed, sprayed or dipped, and is packaged in pints, quarts and gallons. Price is $4.95 per pound (1 pint equals 1 pound), f.o.b. North Hollywood, Calif.

91/Circle on Readers' Service Card

Demineralizer

Penfield Mfg. Co., Dept. MF, 19 High School Ave., Meriden, Conn.

Model U-60C demineralizer features cast acrylic columns, stainless steel cabinet, integral regenerant tanks. Demineralization, at flow rates up to 60 g.p.h., is accomplished in accordance with highly efficient multi-column ion exchange principles. Raw water passes through four columns: two each, alternately, of cation and anion resins. The third and fourth columns remove the more weakly ionized impurities. Thus effective removal of free CO_2 and silica is accomplished and an effluent of exceptionally high purity is provided.



The unit is completely "packaged" — is shipped ready to deliver ultrapure process or make-up water upon simple connection to a plant's service lines. The Plexiglas columns enable the operator to view the resin action in the column at all times. A purity meter provides continuous indication of effluent purity. Construction throughout is 100% non-corrosive, including all piping, valves, screens, eductors, etc.

93/Circle on Readers' Service Card

BOTHERED BY THE HIGH COST OF TANK LINING FAILURES?

Tygon linings are really economical. Not necessarily from the standpoint of low first cost (which can be very misleading), but more important, they provide greater corrosion resistance — more positive protection, hence *longer trouble-free service life*. Tygon's outstanding resistance to oxidizing acids, alkalis, oils and greases make it suitable for jobs too tough for other lining materials to handle. Excellent dielectric properties guard against current loss. Non-oxidizing, flexible, and resilient, it resists aging, wear and abrasion.

Where solution visibility is important, Tygon *white* linings permit maximum visual quality control. Seamless, jointless Tygon linings are installed by a licensed Tygon applicator in your area, reducing delivery time and freight costs to a minimum.

Tygon is the perfect membrane for oversheathing with USSCO acid brick. Built-in-place tanks, tank piers and foundations are lined at your plant to your specifications by trained field applicators. And our engineering service stands ready to help with all your lining problems.

257-E

Send for your copy of the fact packed, illustrated Tygon Lining Bulletin No. TL-526

PLASTICS AND SYNTHETICS DIVISION
U. S. STONEWARE
AKRON 9, OHIO

92/Circle on Readers' Service Card

Silicon Power Rectifiers

International Rectifier Corp., Dept. MF, 1521 E. Grand Ave., El Segundo, Calif.

Optional mounting bases and reverse polarity types in all ratings and mounting styles are design features of the expanded line of hermetically sealed, all-welded silicon power rectifiers for all industrial applications. This series, rated at 45 to 150 amperes (half-wave) with PIV voltage ratings from 50 to 800 volts (pipe-thread, long machine

EGYPTIAN "COMPOSITE BAKE"* METAL PRIMERS can double your oven capacity too!

*"Composite Bake" . . . the simultaneous baking of the Egyptian System of Metal Primers and Top Coat in one pass thru the oven.

Recently one of America's largest Manufacturers of Air Conditioning Equipment† found himself wrestling with the finishing room bug-a-boo that eventually plagues every volume product manufacturer . . . overtaxed oven facilities – resulting in non-productive finishing room man-hours.

At the suggestion of his Egyptian Finishes Specialist he momentarily laid aside the obvious solution . . . additional baking units – and made a trial run, switching to Egyptian "Composite Bake" Metal Primers.

Here's how the tally sheet read: (1)-Oven capacity doubled. (2)– Non-productive man-hours practically eliminated. (3)– No additional baking equipment required.

In addition to these production advantages, Egyptian "Composite Bake" Metal Primers brought these highly desirable finishing characteristics:

†*Name upon request.*

- **EXCELLENT ADHESION to practically any metal surface.**
- **WILL TAKE MOST ANY TOP COAT—Lacquer or Synthetic Enamel.**
- **SMOOTH FILM and excellent "Enamel-Holdout"**
- **GOOD RUST RESISTANCE—Corrosion Inhibiting Pigments.**
- **SUITABLE FOR EXTERIOR EXPOSURES.**

Listening to the complete Egyptian "Composite Bake" Story could point out the way to cut costs in your finishing room too. Invite an Egyptian Industrial Finishes Specialist to call on you TODAY, or write for detailed information. No obligation of course.

EGYPTIAN *Industrial Finishes*

The EGYPTIAN LACQUER MANUFACTURING COMPANY

BOX 444, NEWARK 1, NEW JERSEY

EXECUTIVE OFFICES, ROCKEFELLER CENTER, N. Y. • Plants: South Kearny, N. J.—Lafayette, Ind.

94/Circle on Readers' Service Card

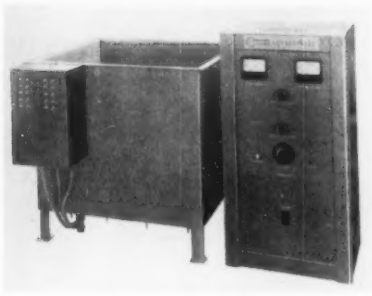
thread and standard machine thread) offers reverse polarity types in each rating and mounting style.

95/Circle on Readers' Service Card

Large Scale Ultrasonic Cleaner

Acoustica Associates, Inc., Dept. MF, 26 Windsor Ave., Mineola, N. Y.

One of the largest capacity ultrasonic cleaning systems yet to be offered as standard equipment, the DR-2000 AH features a cleaning tank measuring 3 feet square by 2.5 feet deep which is fitted with an array of twenty bottom-mounted transducers. These are driven by a simplified pulsed electronic generator delivering 8,000 watts peak power. Either solvent- or water detergent-solutions can be used.



The new equipment features the Model AT-250B all-welded stainless steel enclosed transducers utilizing high temperature ceramic vibrating elements to develop a uniform intensity ultrasonic field across the tank. A unique fused control box is included with the transducerized tank to indicate the operating condition of each transducer.

The compact, trouble-free generator provided with the system operates from 220 or 440 volts, 50/60 cps, single phase power lines and delivers 2,000 watts average power output with an overall conversion efficiency of better than 50%. Spacing between the generator and the transducerized tank may be as great as several hundred yards, and all provisions for remotely controlling operation and operator safety are provided.

Both stainless steel and carbon steel tanks are available as well as special racks and trays which may be needed to facilitate the handling of parts. Custom made tanks of differing size are also avaliable on special order, as are the transducers themselves for applications involving tanks already in use and presently installed automated, mass production cleaning systems.

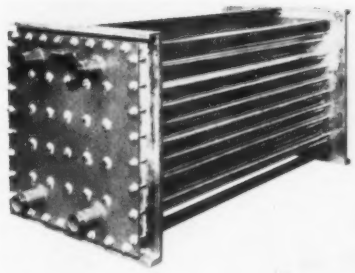
96/Circle on Readers' Service Card

Heat Exchange Coils

Niagara Blower Co., Dept. MF, 405 Lexington Ave., New York 17, N. Y.

Coils for various heat exchange duties in process industries are offered in a complete range of choice. The metals from which these coils are made include aluminum, copper, stainless as well as carbon and alloy steels, and hot-dipped galvanized steel. Coils are manufactured in both prime surface and extended surface types.

All manner of construction specifications are successfully met. Coil types include series flow, serpentine coils, parallel flow coils with special headers, fully cleanable coils, variously partitioned coils, and coils with bends to



various radii. Coils for pressures up to 3000 lbs. are also available.

97/Circle on Readers' Service Card

Organic Coating for Vacuum Metalizing

Bee Chemical Co., Dept. MF, 12933 Stony Island Ave., Chicago 33, Ill.

A new coating, used in conjunction with vacuum metalizing, is designed to cure at low temperatures and has unusual advantages on soft metals. The product designated as M-246H uses the same base and top coat and cures at temperatures of 180° F. to 290° F. Although the coating cures at very low temperatures, it is claimed to be resistant to alcohols, boiling water for one hour, temperatures of 400° F. and have exceptional hardness, adhesion and abrasion resistance. While originally designed for soft metals, it has excellent adhesion and equally good properties when used on thermosetting plastics, such as phenolics, ureas, etc., where curling at higher temperatures causes production problems.

Upon cure, the material has excellent and uniform dye acceptance and produces intense golds as well as brilliant chromes. Dyes and transparent pigments can be incorporated into the top coat.

98/Circle on Readers' Service Card

Acid-Proof Flooring

Hallemite Mfg. Co., Dept. MF, 2446 W. 25th St., Cleveland 13, Ohio.

Amazite, a pure plastic resin, may be applied right over new or old concrete, terrazzo, brick, stone, marble, slate, plaster, metal or wood to provide both complete protection against destructive acids and caustics, as well as rugged resistance to abrasion, it is claimed.

Thick applications may be trowelled on to transform rough, pitted floors into smooth traffic areas. Surfaces in good condition may be protected and preserved by brushing on the treatment like a paint. The plastic hardens overnight into a dense, dustless, leather-tough film that does not chip even when "feathered." Under heavy traffic, ⅛ inch is claimed to outwear 2 inches of concrete.

Depending upon his own choice, the user can produce a finish either as glossy as a china plate or completely skidproof, even if wet, greasy or soapy. Three formulations, for trowel, paint brush or spray gun application, are available in clear (amber), tile red and cement gray colors.

100/Circle on Readers' Service Card

Coated Abrasive Wheel

Behr-Manning Co., Dept. MF, Troy, N. Y.

For polishing and finishing contoured as well as flat metal surfaces, a versatile new flap wheel is made up of hundreds of pieces of coated abrasive cloth, with a stiffened construction

Why buy BLAKESLEE DEGREASING MACHINES

PATENTS can be secured on almost anything. The item patented need not be practical or offer any worthwhile contribution.

PROFIT PRODUCING PATENTS

Practical BLAKESLEE patented features result in economies of operation and savings in solvent consumption. The BLAKESLEE patented anti-diffusion chamber on conveyorized machines cut-off the evaporative area from 50% to 80%.

Another practical patented feature found only on BLAKESLEE degreasers is the patented solvent cooler. This cooler is located just ahead of the water separator and chills the solvent distillate to speed up and insure complete and constant separation of the water and solvent.

OPERATING COSTS

These costs are the most important to consider when deciding on new degreasing equipment; actually the initial machine cost is secondary. The patented features listed here are typical of the many, many features to be found only in BLAKE SLEE degreasers.

It will pay YOU to have a BLAKESLEE man call!

G. S. BLAKESLEE & CO. 1844 So. Laramie Ave., Chicago 50, Ill. NEW YORK • LOS ANGELES • TORONTO

also Manufacturers of Blakeslee Metal Parts Washers and Blacosolv Degreasing Solvent

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COPPER SULFATE NICKEL SULFATE

A COMPATIBLE ~TRIO~

PLATING INDUSTRY

There's reason for Triangle Brand Copper Sulfate and Nickel Sulfate being close friends with the plating industry. Over the years they have proved their DEPENDABILITY.

Why? It's obvious — purity, uniformity, solubility and high conductivity of their solutions result in *quality plating.*

All-important "extras" found in the use of Triangle Brand Copper Sulfate and Nickel Sulfate yield long-life plating performance that *makes the difference.*

Insist on Triangle Brand Copper Sulfate and Nickel Sulfate for dependable plating baths.

And remember, Phelps Dodge is also a basic producer of
SELENIUM TELLURIUM

PHELPS DODGE REFINING CORP.
300 PARK AVE., NEW YORK 22, N.Y. • 5310 W. 66th STREET, CHICAGO 38, ILL.

101/Circle on Readers' Service Card

which allows it to resist pressure, giving production rates and a useful life not hitherto available in wheels of this type. The new wheel is particularly suited for use on fully automatic polishing operations. Also, it may be used on any standard bench grinder in place of a wire brush for the many small polishing jobs.

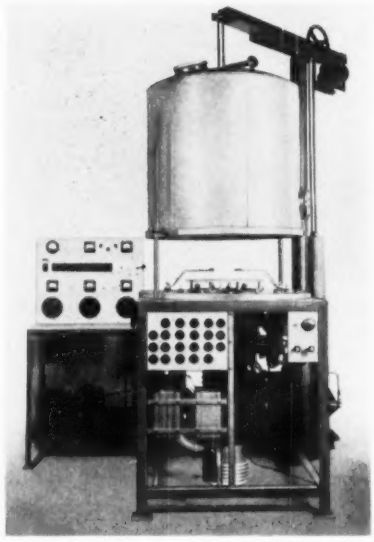
The wheel is furnished with aluminum oxide or silicon carbide abrasive in a wide range of grit sizes, a variety of hole sizes and in wheel sizes from 6 x 1 up to 16 x 6 in. Ten inch and smaller wheels are furnished with built-in disposable metal flanges. Reusable flanges are sold separately for use with the larger wheels. Each wheel is marked with an arrow to show direction of rotation, and stamped with the maximum permissible speed.

102/Circle on Readers' Service Card

Vacuum Metalizer

Vacuum Equipment Div., The New York Air Brake Co., Dept. MF, Camden, N. J.

SC-2 high vacuum evaporator has been expressly designed for laboratory and pilot plant use. It features extra pumping capacity for fast pumpdown, with a 4″ high speed, four-stage oil diffusion pump backed by a 13 cfm single-stage mechanical pump, attaining operating pressures in less than 10



minutes and an ultimate vacuum of 1×10^{-5} mm Hg.

The design of the unit is claimed to facilitate work; with all controls, dials and switches located at the front of the unit, readily accessible and clearly in view. A working surface area for notes, etc. is located immediately in front of the operating panel.

The standard vacuum tank is a 12″ diameter by 18″ high Pyrex bell jar which is provided with a metal screen guard and counterweighted lift. Base plate is solid steel ¾″ thick and 20″ in diameter, accommodating bell jars to 18″ diameter and 30″ in height. The base plate has 12 electrical terminal posts and a rotary-motion device is installed for manual rotation from below the base plate.

103/Circle on Readers' Service Card

Level Control

Automation Products, Inc., Dept. MF, 3030 Max Roy St., Houston 24, Tex.

Model CL-10 "Dynatrol" utilizes new design principle for extremely accurate and versatile high or low point detection or narrow range proportional control of liquid, solid and slurry levels. This small and rugged control has a positive acting electrical output control signal that varies with the amount of immersion of the vibrating paddle in the medium being detected. The output signal can be used to control the operation of any type of electrical equipment. The unit is rated for 3,000 pressure, is explosion proof, 115 volt, corrosion resistant, for any mounting position with only ¾″ pipe opening required.

104/Circle on Readers' Service Card

Vibrating Barrel Finisher

Lord Chem. Co., Dept. MF, 2068 S. Queen St., York, Pa.

The new "Lorco Vibrator" employs the principle of controlled vibration and permits a certain flexibility in vibrational frequencies and amplitudes. The vibrator can be supplied for either fixed or variable amplitudes and frequencies.

This new machine will do everything that the conventional tumbling barrel will do and more and is said to be from 10 to 100 times as fast. It is not just a tumbling barrel with vibration added but a different type of machine altogether, designed along wholly different principles. In the conventional tumbling barrel, the workpieces are carried upward with the media to a certain height, from which they cascade downward as the barrel turns. All of the work is done in the "slide." In the vibrator, every cubic inch of load is in continuous work motion as against the limited slide in the tumbling barrel. In addition, there is also present a highly effective "scrubbing action," which is caused by frequency and amplitude.

In comparative stock-removal tests, the vibrator is claimed to have removed 200 times as much metal as the tumbling barrel during the first 30 minutes. This ratio in favor of the vibrator diminished as the time cycle was lengthened.

Heavy burrs that other machines could not remove economically have been neatly taken off in a short time. To a certain extent, the vibrator will also work in recessed and shielded areas, which are difficult or impossible to reach with the conventional tumbling process.

ARMORHIDE® coating on IBM 305 RAMAC

New metal coating looks like leather and is ten times more abrasive resistant.

Basically a textured plastic finish applied to metal and resembling leather, Armorhide is characterized by very high abrasion and chemical resistance. Similar to laminated Vinylite, Armorhide does not require expensive solvents and is sprayed on metal at a minimum of 60% solids at the gun.

Thus Armorhide is a new and entirely different kind of finish with physical and chemical properties unlike any other finish.

Write today for free booklet and sample panel.

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Synthetic Enamels, Paints, Varnishes, Lacquers
245 THOMAS STREET . . . NEWARK 5, NEW JERSEY

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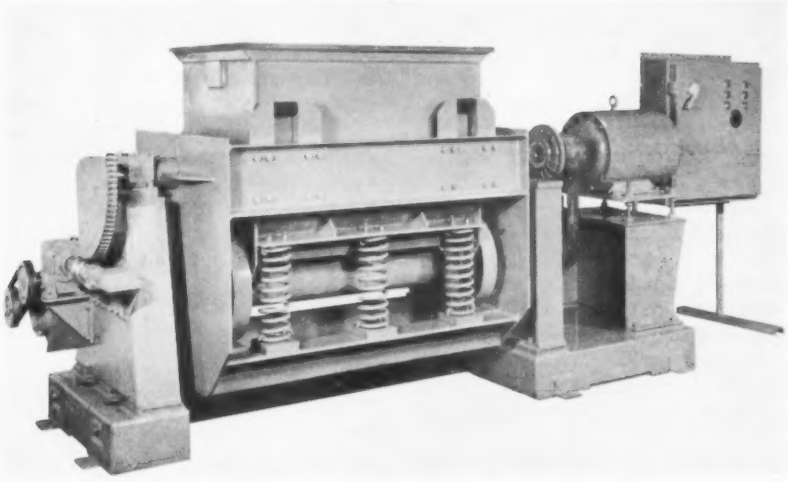

The new machine will handle almost anything, from extremely coarse work to very fine finishes. It is readily adaptable for use in automated production lines.

Models currently available range from 10 to 30 horsepower and in bowl capacity from 6.92 to 17.50 cu. ft. Smaller models are contemplated.

106/Circle on Readers' Service Card

Painting Machine

Finish Engineering Co., Inc., Dept. MF, 1115 Cherry St., Erie, Pa.

This new painting machine, the Model 4800, gives better decorating with lower labor cost — due to improved spray coverage. The guns spray

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WHAT
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Ty-Bond
Actual Ty-Bond Panel
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Cowles Ty-Bond Zinc Phosphate Coatings give your paint, enamel, lacquer, or other finishes a base to grab and hold.
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CHEMICAL COMPANY
CLEVELAND 3, OHIO

107/Circle on Readers' Service Card

down, and the exhaust is down, allowing coverage of outside edges, without overspray in the operator's face. Since the guns tilt during spraying, ends of shaped objects can be painted at the same stroke that paints the top and sides. While this machine is particularly suited to painting large parts, the gun stroke is adjustable to permit efficient spraying of smaller pieces.

The part is held firmly in the mask during spraying, by a pressure pad actuated by an air cylinder. This prevents overspray on unwanted areas. Reciprocating action of the guns is by chain drive, powered by a hydraulic unit. The machine always completes a paint stroke, never starts or stops spraying in the middle of a part, and the number of spray strokes is adjustable.

108/Circle on Readers' Service Card

Aluminum Alloy for Bright Finishing

Aluminum Co. of America, Dept. MF, 730 Alcoa Bldg., Pittsburgh 19, Pa.

A new aluminum sheet alloy is designed to produce a super-bright anodized finish. When polished, brightened and anodized, the moderately priced sheet, designated alloy X5457, offers a lustrous mirror-like appearance.

Products fashioned from the new

sheet alloy exhibit mechanical properties similar to alloy 5357 and can be rolled to the same manufacturing specifications. It is expected to replace alloy 5357 in various decorative trim applications where optimum brightness is desired.

The finish achieved after polishing, brightening (chemical or electro-brightening) and anodizing approaches a luster previously obtainable only on super-purity aluminum.

Samples of the new sheet are available for both commercial and developmental applications.

109/Circle on Readers' Service Card

Polyethylene Tanks

American Agile Corp., Dept. MF, 5461 Dunham Road, Maple Heights, Ohio.

New standard polyethylene tanks are self-supporting, light in weight, chemicaly inert, non-contaminating, and are engineered for long, trouble-free service.

The line is composed of three basic types. Cylindrical, self-supporting tanks, 22⅝" O.D., 22" I.D., 34" deep, ½" thick bottom, with 55-gallon capacity; square, self-supporting tanks with 25-gallon capacity, 18" x 18" x 18" I.D., ½" thick wall throughout; and rectangular, self supporting tanks, 20" x 12" x 20" deep, I.D., ½" thick wall throughout.

Where required, tanks can be supplied with mixing and stirring equipment, outlets, covers, sight glasses, overflows and similar fittings.

110/Circle on Readers' Service Card

Spray Booth

Schweitzer Equipment Co., Dept. MF, 3764 Ridge Road, Cleveland 9, Ohio.

A new spray booth, tradenamed "Hydrex," employes a series of special spray jets which perform the dual job of creating a draft of air through the

LEA Copper-Glo

KEY TO BETTER COPPER PLATING

Lea-Ronal Bright Copper Process

Here's a bright copper process using Lea Copper-Glo . . . it's a process producing a high speed, buffable, bright plate of high uniformity.

The Lea-Ronal Bright Copper Process has a tremendous tolerance to contaminants such as chrome, zinc and carbonates. Formulations are available either with or without tartrates or tartrate substitutes.

Recommendations available from our engineers and laboratories provide the "aspirins" for conditions which are the "headaches" of other cyanide copper plating processes.

How about your copper plating process? Can the same be said for it? Or, is there a constant battle with contamination and constant uncertainty as to uniformity and quality of plate and even as to the length of the plating cycle?

Why not look into this process now? In writing for the newly revised Copper-Glo Technical Manual, please describe your present problems and requirements.

For more information, write to The Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 20, Connecticut.

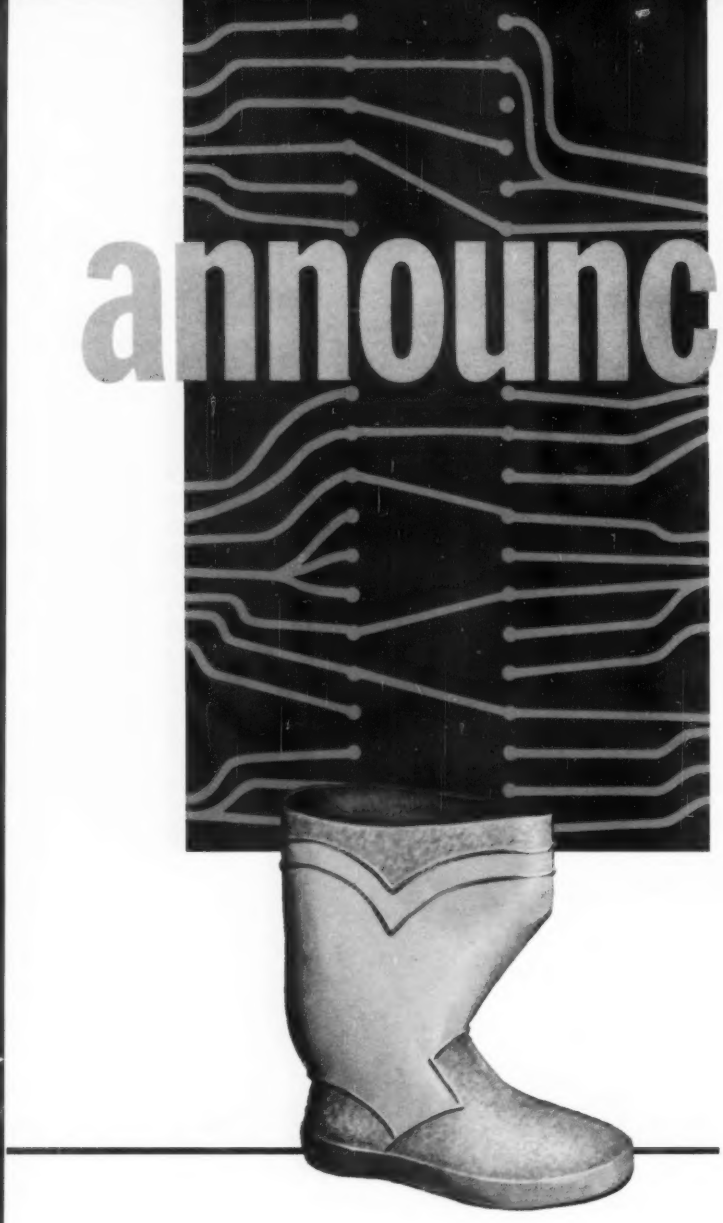
Lea-Ronal *Inc.*

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.
Main office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.

Are you interested in Plating Specialties? SEE THE OTHER SIDE OF THIS INSERT.

announcing...

the Cuprotype Process*



an acid-copper process for producing smooth, ductile, tree-free, heavy deposits at high speed

CUPROTYPE is a new production-tested acid copper process that provides a valuable asset to platers requiring heavy copper deposits that are smooth, ductile and tree-free, even when deposited at high current densities. CUPROTYPE is being used in electro-forming of molds, in plating of non-conductors such as printed circuits, and in electrotyping.

Plating speeds with CUPROTYPE range from 50% to 100% higher than for other acid copper processes now in commercial use. For example, one manufacturer plating molds was able to increase his rate of deposition 100% and still get smooth, ductile, tree-free deposits.

Plating thickness can be markedly increased without increasing tank capacities or plating time. Addition agents are completely stable. There is no breakdown or deterioration of solution.

If you are now or expect to be working with products requiring exceptionally heavy copper deposits, you should investigate CUPROTYPE. A letter or call to our sales offices will bring full details. Our laboratory, as always, is available for any technical help.

CUPROTYPE is one of the newer developments in a line of superior plating processes developed in the Lea-Ronal Laboratory, one of the foremost in the country in the field of specialized plating processes. CUPROTYPE has been production tested on a variety of products, each coming up with the same report: superior deposits in faster time.

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Lea-Ronal, Inc., Jamaica, N. Y.
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*A patented process

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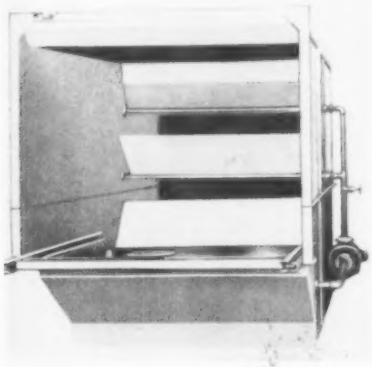
booth as well as providing a turbulent water mist which precipitates the dust and overspray from the air. Since the entire air movement through the booth is accomplished by the jet action of the nozzles, the spray mist intimately mixes with, surrounds and drags down the paint particles, causing them to precipitate. The precipitated overspray is collected in the reclamation chamber which is built into the booth and which may be reclaimed by conventional methods. Water for the spray jets is contained in a closed system and is circulated by a small pump and motor attached to the side of the booth. The exhaust blower normally used to create a draft through the booth is completely eliminated.

In many cases, all air used by the booth is returned directly to the room atmosphere, thus reducing the heating load; particularly during the winter months. However, air may be recirculated back into the front of the booth, exhausted to the outside, or directed to all three destinations, the proportion being determined by the type of solvent, type of material being sprayed, amount of overspray and other similar variables. The adjustment of air flow is simple.

Advantages claimed for the unit include: simplicity of construction and operation; ease of cleaning; high percentage of air recovery with consequent reduction in heat loss; high rate of overspray recovery; elimination of complex stack systems permitting the booth to be built as a portable or semi-portable unit.

The booth is available in a number of standard sizes for both hand and automatic spraying. Provisions can be made for the use of conveyors or other mechanical handling devices. Booths



with either galvanized or stainless steel walls are available.

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From the smooth feel of perfectly polished stainless steel tableware to the contoured grips on modern power tools, Jewel Brand Coated Abrasives are bringing fast, efficient grinding, smoothing and polishing to the manufacture of hundreds of products. Because *end products cost less when you finish with Jewel Brand Abrasives*, it will pay you to bring their many advantages to bear on your finishing problems. Order now from your Industrial Distributor or write for specific recommendations.

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BUSINESS ITEMS

Simon P. Gary Joins Scientific Control Laboratories, Inc.

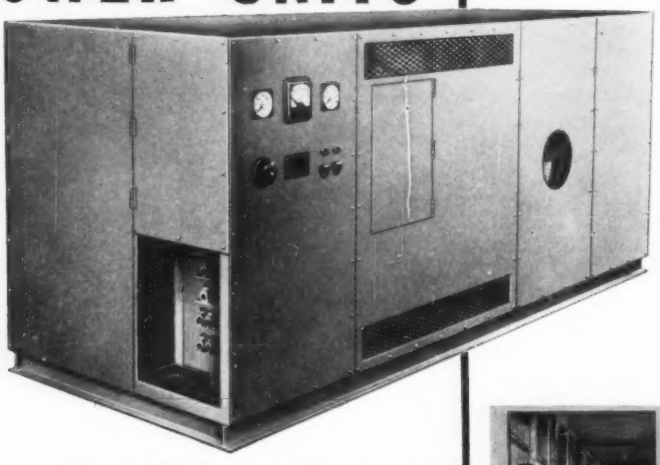
Scientific Control Laboratories, Inc. announces the appointment of *Simon P. Gary*, as vice-president. Gary has practiced as a chemical engineer and consultant in the electrochemical and metal finishing fields since his graduation from Rose Polytechnic Institute in 1941. He brings to his new assignment a considerable background of theoretical and practical "know-how"

Simon P. Gary

SYNTRON

a-c to d-c

SELENIUM RECTIFIER POWER UNITS

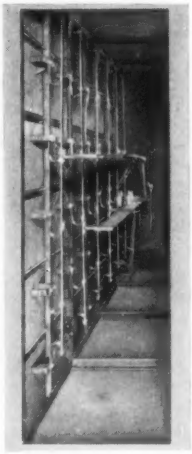


provide efficient, dependable d-c power supplies for better, more profitable metal finishing

SYNTRON Selenium Rectifier Power Units are designed for all your a-c to d-c power conversion needs. Ideal for electro plating, cleaning, polishing and electro chemical processing.

SYNTRON Selenium Rectifier Power Units are engineered to give maximum service with a minimum of cost. The high efficiency, excellent power factor, rugged construction, proven dependability, simplicity of installation and low maintenance make SYNTRON Selenium Rectifier Units the most outstanding power conversion unit in their field.

SYNTRON Selenium Rectifier Power Units can provide efficient, economical, dependable d-c power supplies for your operation.



Interior arrangement of rectifier stacks and heavy bus work.

- power factor 97% efficiency
- Lower cost per KW
- Lower maintenance
- Dependability
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MF 258

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gained through his various positions which include: chemical engineer in the Research Division of Prest-O-Lite Battery Corp., and in the Allison Division of General Motors Corp., following which he served as a research engineer for Plastic Platers, Inc., until the close of the war when he joined the staff of Scientific Control Laboratories as a research engineer and consultant.

In 1950 he became plant manager of Grunwald Hard Chrome Plating Co. where, in addition to his duties of management, he developed methods and processes for the production of electrodeposited chromium for industrial and engineering uses. In 1957, he rejoined the staff of Scientific Control Laboratories as a consultant and as director of the quality control laboratory.

DuBois Constructing New Plant in New Jersey

Construction is under way on a 53,022 square foot manufacturing plant for *The DuBois Co., Inc.*, Cincinnati, in East Rutherford, N. J.

Underhill Elected V.P. at Seymour

George Townsend Underhill has been elected to the newly-created post of vice president in charge of sales for *The Seymour Mfg. Co.*, Seymour, Conn., producers of nonferrous metals. The appointment is effective immediately.

From 1956 until assuming his present position, Mr. Underhill served as vice president and sales manager of Victor Mfg. & Gasket Co., Chicago. Prior to that he was associated with The Chase Copper & Brass Co. for 27 years, serving in various capacities and rising to Chicago district sales manager. From 1926 to 1929, he was

George Townsend Underhill

with F. Schumacher & Co., New York, as salesman and assistant manager.

Clinton Supply Appoints Gray

The appointment of *Stanley H. Gray* as technical sales representative has been announced by *Clinton Supply Co.*, Chicago, Ill.

Mr. Gray attended the University of Cincinnati, where he majored in Metallurgical Engineering. Before joining Clinton Supply he had been associated with the Stolle Corp. in the Cincinnati, Ohio, the National Sherardizing Co. in Hartford, Conn., and the Chicago branch of Wagner Bros. Inc.

In his new capacity Mr. Gray will cover the greater Chicago area as well as Northern Indiana, Wisconsin and downstate Illinois.

Parker Rust Proof Promotes Roosa

Max B. Roosa, formerly vice-president in charge of sales, has been elected executive vice-president of *Parker Rust Proof Co.*, Detroit, manufacturer of surface treatments for metals.

Mr. Roosa has been with the firm since 1936, joining the company after graduating from the University of Michigan with a degree in Chemical Engineering.

Beginning as a research chemist, he has held progressively more important positions in the sales and service departments. He was made sales manager in 1951 and vice president in charge of sales in 1952.

American Instrument Appoints New Sales Representative

American Instrument Co. announces the appointment of a new sales repre-

Herman C. Zwart

FOR NON-LUBRICATING AND CORROSIVE FLUIDS

You asked for it . . .

and Eco is the only manufacturer who has made it available. The first self-priming rotary gear pump suitable for non-lubricating and corrosive fluids is now available for immediate delivery. The pump, with ¾" P.T. inlet and outlet ports, features housings of 316 or Carpenter 20 stainless steel, Hastelloy C or nickel, with reinforced Teflon gears and internal Teflon bearings and packing.

Designated the GearChem*, this pump is suitable for speeds to 1750 rpm at capacities to 10 gpm and pressures to 100 psi. Viscous media to 5000 SSU can be pumped at reduced speeds.

The GearChem created tremendous interest at the recent Chemical Show. In addition to proportioning and metering applications the pump is ideal for general process work in pilot plant and production operations.

Write for prices and complete information.

* T.M. Applied For

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the big name in small pumps
MArket 4-6565

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- Washes
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- Steel
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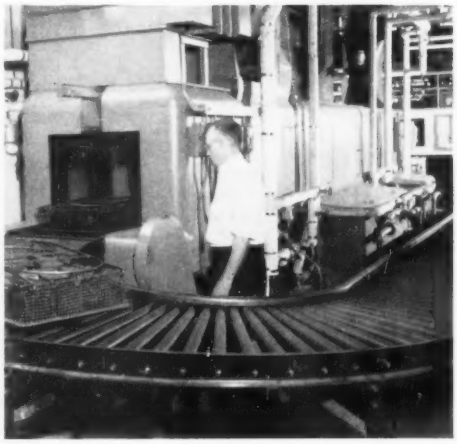
- Aluminum
- Stainless
- Stampings
- Castings
- Screw Machine Parts
- Die Castings
- Machined Parts
- Forged Parts

In many cases, Cincinnati engineers are called upon to design equipment to clean one particular part. In others, they have to come up with a machine that will clean anything in the plant . . . present and future! Installed in the New York State division plant of a noted American manufacturer, the machine illustrated is such a "jack of all trades". It handles all pre-finishing, pre-inspection and pre-assembly cleaning for the complete plant. It's another example of Cincinnati's ability to engineer equipment to a problem and to a budget, too.



What's your problem? Ask for a no-cost, no-obligation survey of cleaning requirements by: **Cincinnati Cleaning & Finishing Machinery Co., 2027 Hageman St., Cincinnati 41, Ohio**

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sentative with offices located at 1485 Bay Shore Blvd., San Francisco, Calif. *Herman C. Zwart* has been named to head the new post, and will be the firm's second representative in California and 14th throughout the United States.

A graduate of Lehigh University in chemical engineering, Mr. Zwart has had varied experience in engineering, sales and sales promotion in both industry and in the military.

Metallurgist Becomes Affiliated With Sam Tour & Co.

Oliver E. Shipp, metallurgist of Newburgh, N. Y., has become affiliated with *Sam Tour & Co., Inc.*, and the *American Standards Testing Bureau Inc.*, of 44 Trinity Place, New York 6, N. Y.

Mr. Shipp received his training in Metallurgical Engineering at Rensselaer Polytechnic Institute at Troy, New York. His experience includes 3 years in mining of ores, 5 years in product and materials engineering in the aircraft industry, 6 years in metallurgy in the aircraft and aircraft engine field, and 2 years in the metallurgy of manufacture of electrical conductor wire and cable.

Name Officers of Vaculite Corporation

New officers of *Vaculite Corp.*, metalizing firm, have been announced. Appointed were *Henry W. Rigby*, president; *Maynard D. Conklin*, treasurer and *Frederick H. Greene, Jr.*, vice president and general manager. *Richard M. Nichols* is secretary and clerk and *David D. Nickerson* is assistant treasurer. *Allan R. Dragone* continues as assistant general manager and sales manager.

Vaculite is jointly owned by National Research Corp., Cambridge, Mass. and Champion Paper and Fibre Co., Hamilton, O. Sales and production facilities are located at 70 Memorial Drive in Cambridge.

Mill Heads New Trerice Dallas Office

Richard Mill

Richard Mill has been appointed manager of the new Dallas branch office of the *H. O. Trerice Co.* The office is located at 4252 Harry Hines Blvd.

Mr. Mill is a graduate of Michigan State University, and served in the firm's Detroit, Mich., home office prior to his transfer here. From Dallas, he will cover Texas, Oklahoma and New Mexico.

Diamond Alkali Appoints Two

Two important staff appointments in *Diamond Alkali Co.'s* Silicate, Detergent, Calcium Division at Painesville, Ohio, were announced recently.

Chester D. Rudolf, group leader of the division's research and development activities for the past three and a half years, becomes general superintendent of the division. At his new post, he will be responsible for coordinating divisional operations at the Painesville Works.

George V. Olle, since 1949 assistant

superintendent of the pure calcium products plant, moves up to the position of superintendent, succeeding *Raymond R. McClure*, a veteran of 29 years' service with the firm in the calcium carbonate field, who recently retired. He had held this post since October, 1948.

Rudolf, who joined the company in 1954, was formerly associated in an engineering capacity with the New Jersey Zinc Co. at its Palmerton, Pa., and DePue, Ill., plants. Born in Connecticut, he is a graduate of the University of Wisconsin.

Olle, a native of Conneaut, O., has been associated with the company since 1929, where he started as assistant foreman of the pure calcium products plant. Promoted to foreman in 1941, he became assistant superintendent eight years later.

Atkinson Joins Rinshed-Mason

Everett W. Atkinson has joined the sales-engineering staff of the *Rinshed-Mason Co.*, manufacturers of organic finishes.

Everett W. Atkinson

Atkinson will work exclusively with finishing problems of mobile home manufacturers. He has had over 23 years of paint supervisory experience with two leading mobile home builders, and is completely familiar with interior and exterior production painting techniques. He has also had over two years experience in technical service and sales in the paint manufacturing industry.

Appointments Announced By Minnesota Mining

Appointment of *Robert N. Wolfe* as general manufacturing manager, adhesives, coatings and sealers division, has been announced by *Minnesota Mining & Mfg. Co.*

At the same time, the firm announced the appointment of *Walter C. O'Leary* as technical director for the division, reporting directly to Wolfe, whose new responsibilities include research, product development, technical service, field service and manufacturing development, as well as the direction of all manufacturing plants of the division.

Wolfe, who joined 3M in 1939, was formerly divisional production manager. O'Leary, who came to the company in 1947, was previously manager of the division's laboratory at the main plant and home office in St. Paul. In his new position, he will headquarter in Detroit, and will be responsible for all of the division's research, product development, technical service and field service activities.

Wolfe is a director and past president of the Detroit society for the Advancement of Management, and a member of the Engineering Society of Detroit, the Detroit Rubber and Plastics group and the Employers Association of Detroit. He is a graduate of the University of Minnesota.

O'Leary, a graduate of Detroit University, is a member of the American Chemical Society.

Reconsider the source of your D-C power

DOES IT *AUTOMATICALLY* MAINTAIN CONSTANT VOLTAGE TO YOUR TANK?

THER REACTRON DOES!

GERMANIUM OR SELENIUM TYPES

DOES IT ALSO GIVE YOU:

- Stepless Voltage Variation
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- Small, remote operator's panel
- Static saturable reactor
- Advanced magnetic amplifier design
- Fast response and wide control range

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Reduced Maintenance Cost:

THER REACTRON eliminates tap switches, vacuum tubes, motor driven brushes, arcing contacts, gears and other moving parts.

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Write for technical study of REACTRON vs. TAP SWITCH or MOTOR DRIVEN VARIABLE AUTO-TRANSFORMER installations.

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Canadian Licensee: Alloycraft Ltd., Montreal

THE *Chemical* CORPORATION

58 Waltham Ave., Springfield 9, Mass.

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American Air Filter Completes Acquisition of Kennard

American Air Filter Co., Inc., has formally completed, through an exchange of common stock, the acquisition of *Kennard Corp.*, St. Louis manufacturer of heating and cooling coils, and heating, ventilating and cooling units.

Kennard was chartered in 1934 and its founder-president is 47 year old *Sam M. Kennard III*. It employs 200 persons in its new 100,000 square foot plant in a suburb of St. Louis. Its products are sold by representatives located in 40 cities throughout the country.

Harper Appointed H-VW-M Chief Mechanical Engineer

Willard J. Harper has joined *Hanson-Van Winkle-Munning Co.* as chief mechanical engineer, and will head all mechanical design engineering, which has been integrated into a newly created group at the company. His appointment follows closely the announcement of major reorganization of the firm's entire engineering division.

Willard J. Harper

A mechanical engineering graduate of the University of Kentucky, Mr. Harper comes to this appointment from the Hydraulic Drives Dept. of the Westinghouse Electric Corp., where he was section manager of a group of engineers. Other previous experience includes work in the research and development laboratories of the Hughes Aircraft Co. as a supervisory engineer.

Raffi & Swanson Honors Wingersky

Raffi & Swanson, Inc., on February 7, 1958, honored *Samuel H. "Sam" Wingersky* as the sixth employee to reach the coveted twenty-five year service mark by presenting him with a beautiful 8-Bell chime ship's clock properly inscribed to commemorate the event.

Mr. Wingersky graduated in chemical engineering from Northeastern University in 1934. He first came to the firm as an undergraduate from the Department of Co-operative Work and joined the company in the research department after graduating as a chemist. Mr. Wingersky was appointed manufacturing superintendent in 1952.

George Schore Joins Brucar

Jerome Alter, President of the *Brucar Equipment & Supply Co.* of New York City, has announced that *George Schore* has become an associate and partner of the firm. Mr. Schore graduated from the College of the City of New York as a Bachelor of Science in Chemical Engineering. He has held many responsible positions in both sales and production.

The company, which for sometime has enjoyed a reputation as a new and used equipment and supply house, will now include engineering services, specialties, brighteners, plant design, and installation as part of its services. The engineering and technical services will be under the direction of Mr. Schore, whose experience and reputation has long been known to the industry.

George Schore

Mr. Schore has been most active in the American Electroplaters' Society: he is a member of The Electrochemical Society, American Society for Metals and Institute of Metal Finishing.

Representative Added To Adelphi-Baer Sales Staff

Adelphi Paint and Color Works, Inc., has announced the appointment of *Gabriel Romain* as an industrial sales representative for this company.

Mr. Romain, the former owner of the Romain Paint Co., will call on industrial firms throughout lower Connecticut and Metropolitan New York. Mr. Romain's long successful sales background should prove invaluable to the company as well as to those accounts on whom he will call.

New Distribution Terminal for Liquid Caustic

A storage and distribution terminal for liquid caustic soda has been established at Bedford Park, Ill., outside of Chicago by the *Industrial Chemicals Division* of *Olin Mathieson Chem. Corp.*

Located on the Chicago Sanitary and Ship Canal, Archer Avenue and Roberts Road, the facility consists of tank storage, barge unloading and tank truck and railroad tank car loading and weighing equipment.

Barrett Chemical Appoints Distributor

Barrett Chemical Products Co., Inc. of Shelton, Conn., manufacturers of sulfamate nickel plating process and allied products announces the appointment of the Los Angeles Branch office of *Chas. F. L'Hommedieu & Sons Co.* as a distributor and technical service representative in California, Arizona and New Mexico.

The office in Los Angeles, under the experienced direction of *Lawrence O'Neil*, handles a complete line of materials for the polishing and plating industry. Warehouse stocks are maintained and analysis service provided for customers.

Technical service will be under the personal direction of *Harvey K. Hunt* who has worked in the area with Barrett products for a number of years.

Hill Acme Research Building

Hill Acme Co., Cleveland, Ohio, manufacturer of hydraulic surface grinders, abrasive belt grinders and polishers, and other types of machines, have completed a new research building, purposely located separate and apart from its main manufacturing facilities so that development and experimental work can be conducted on new machines without interrupting the normal production schedule in the plant. The new building is serviced for the entire length of its 60 ft. bay by a 10-ton pendant operated crane with a 16 ft. hook clearance.

The purpose of this research building is to process representative quantities of customers' material, thereby establishing and proving technique, quality and production available on the manufacturer's new type machine tools. At any time, the tools in operation in the new building might be changed to make room for new or varied machines that the company develops.

So that all types of ferrous and nonferrous material, some being inflammable, can be ground or polished on the abrasive belt machines, a special wet type dust collector is installed in the building. This collector can be connected by ducts to as many machines as necessary.

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distinctly different finish
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Nacromer®

Nacromer is the synthetic pearl concentrate that is equal to or more lustrous than the finest grades of natural pearl essence, yet, sells for a fraction of the cost. By merely adding a small amount of Nacromer to your regular coating material, and applying by brush, spray, or dip (without any additional labor or equipment), you create a finish with a distinctive pearly lustre.

Nacromer is widely used for coating wood, metal, plastic, leather, paper, and other materials. It can give your product the sales appeal you are looking for.

Why not prove it to yourself. Tell us the nature of the coating vehicle you use, and we will send you the information you need.

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"World's Largest Producers of Pearl Essence"
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the NEW

TIMESAVER

SPEEDBELT "12"

*Trade Mark

. . . speeds finishing, polishing and deburring operations

Now, for the first time finishing, polishing and deburring of small metal parts, stampings and forms can be put on a production line basis. The new Timesaver *Speedbelt* "12" equipped with conveyor belt or roller feed tables can be set in the production line to accelerate production and cut unit costs. Deburring jobs on small metal stampings that previously took up to 20 man-hours can now be done in 2 or 3. The *Speedbelt* "12" makes the entire operation automatic, eliminating tedious hand work or operations on back stand machines.

The Speedbelt "12" is of the same rugged construction as its larger and well known counterparts; the Timesaver "Speedbelt" Models SPL and TOP. Compact in size, with a 34" feeding height, it can be adjusted for fine metal removal on stock up to 2" thick. Abrasive belts can be changed in one minute or less and feed speed is variable from 20 to 50 SFM.

Investigate the advantages of the Speedbelt "12" for your shop. Its possibilities for increasing production and cutting costs are unlimited. Write today for folder and prices.

Pioneers in Wide Belt Sanding for the Woodworking Industry

TIMESAVER SANDERS

Box 7446, Robbinsdale Station Minneapolis 22, Minn.

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Stanley Chemical Co. Sales Meeting Held

A sales meeting of *The Stanley Chemical Co.* of East Berlin, Conn., manufacturers of industrial coatings and plastics, met February 5 and 6 at the company's home office to discuss the expanding market and future growth in the chemical industry. *Valentine B. Chamberlain, Jr.*, sales manager, with hand on lecterne, conducting the sessions. Sales representatives (l. to r.) standing are: *Malcolm G. Nichols, Lucian H. Stevens, James B. Orr, Chester F. Rental* and *John G. Vogel.* Seated, (l. to r.) *Emery B. Slaght, Stanley M. Hunt, Robert T. Kubinak, Walter W. Tesch, Frederick H. Langhorst* and *John A. McConochie.*

Conversion Chemical Products To be Manufactured and Sold in Canada

Conversion Chemical Corp. has announced that *Nicromatic Ltd.*, 20 Drummond St., Toronto, Can. has been licensed to manufacture and sell the former's chromate conversion coating products in the Dominion of Canada. Nicromatic has sales offices in Windsor, Toronto, and Montreal.

Rust-Oleum Completes Plant Expansion Program

Completion of a two-year $600,000 plant expansion program was recently announced by *Rust-Oleum Corp.*, Evanston, Ill.

New additions include enlarged office space and a new company cafeteria in the administrative buildings. New production facilities in the manufacturing division include a three-story, 12,000 square foot warehousing unit as well as the installation of new ball mill equipment and a new automatic packaging system.

Boyles Galvanizing Purchases Jarrett Plating

Boyles Galvanizing of Colorado has purchased the assets and business of *Jarrett Plating Co.*, 1239 9th St., Denver, from *Clyde E. Clarkson.* Clarkson will join Boyles as sales manager of the plating department, and the present staff will continue. *Cecil Pennebaker* of Burlington, Iowa, has been named manager of production and is in charge of quality control of the plating department.

The plant will install the most modern electroplating facilities in Colorado during 1958 at a cost of $100,000. The company plans additional expansion and improvement of facilities during 1958, which will be announced as the year progresses.

Elections at Canadian Hanson Van Winkle Co.

William Whalen, president of *Canadian Hanson and Van Winkle Co.*, manufacturers of metal finishing equipment and supplies, has been elected chairman of the company's board of directors, and *Arthur C. West*, vice-president and general manager, has been elected as president and general manager.

William Whalen

Arthur C. West

Mr. Whalen joined the firm in 1921. He served as general sales manager, assistant general manager, general manager and vice president before becoming president in 1955.

Mr. West joined the company as chief chemist in 1934, was appointed assistant general manager in 1945, and vice-president and general manager in 1956.

Nicromatic Ltd. Licensed By Enthone

Enthone, Inc. of New Haven, Conn., a subsidiary of *American Smelting and Refining Co.*, has announced the appointment of *Nicromatic Ltd.*, 20 Drummond St., Toronto, to manufacture, distribute and service the complete line of the former's products for the metal finishing industry. The licensing arrangement covers Eastern Canada.

Nicromatic's technical personnel have been trained in the application and general servicing of the products, and will be assisted by Enthone service engineers.

Acoustica Opens West Coast Plant

Acoustica Associates, Inc., Mineola, N. Y., maufacturers of ultrasonic equipment, has opened a West Coast plant and research center in Culver City, Calif.

Frank De Luca, formerly a military contracts manager with American Machine & Foundry Co.'s Turbo Division in Los Angeles, was named manager of the new plant, which is located at 11601 North Jefferson Blvd., Culver City.

Grottger Joins Industrial Finishes Co.

Dr. Miro A. Grottger, chemical engineer of Norristown, Pa., has joined *Industrial Finishes Co.* of Philadelphia as vice president and director of research. Grottger's last post was as chief chemist and director of research and development for Walker Bros. of Conshohocken, Pa. In his new post, Dr. Grottger will assume complete charge of all basic research; direct product research and testing; and further act as a special field consultant on customer protective coating problems.

He holds a Professional Engineer's license in the state of Kentucky and received his Ph.D. in chemical and industrial engineering at Chicago University's McKinley Graduate College. From the year 1928 to date, his positions have included chief of research for Delkote, Inc.; chief chemist/research & development for the War Department; chief chemist, Chas. R. Long Paint & Varnish Co.; consulting metallurgist, and at a later date consulting chemical engineer for Pratt Institute; and chemical engineer for the War Department's Quartermaster Corps. He is a member of the Kentucky Society of Professional Engineers, American Federation Paint and Varnish Production Clubs, and the American Society for Testing Materials.

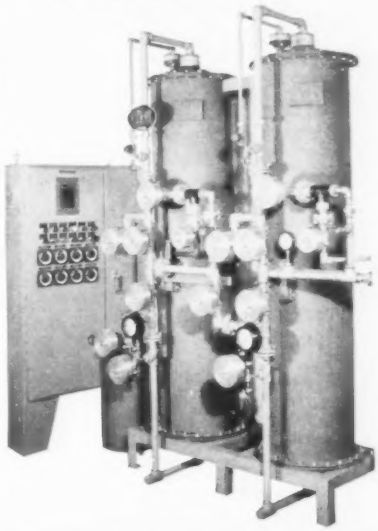
Neilson Chemical Moves To Larger Plant

Neilson Chemical Co., for 28 years manufacturers of products for phosphate coating, cleaning and preparing metals for painting, announces new quarters at 2300 Gainsboro, Detroit 20 (Ferndale), Mich.

ILLCO-WAY ionXchange

NOW!

NEW IDEAS IN AN EFFICIENT . . .



AUTOMATIC DE-IONIZER

New, simplified, pneumatic ILLCO-MATIC valve-operators, designed and built especially for this service, are featured on the two-bed Automatic De-Ionizer shown above. *ILLCO-WAY Two-Bed or Mixed-Bed De-Ionizers, equipped for automatic operation, can be built to any service or cycle your processes require.*

EASILY ADJUSTABLE

The control panel for ILLCO-WAY Automatic De-Ionizers features a set of adjustable Timers, one for each operation. Instant readjustment of the time of any cycle is thus possible, giving the user full flexibility to meet any conditions. Automatic sensing devices can be set to start the regeneration cycle under any specified requirements. *For further details, consult your ILLCO-WAY representative, or write to . . .*

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840 Cedar St.
Rockford, Ill.

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

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Stoner Mudge Adds to Facilities

Stoner Mudge Co. has announced completion of a research and development center that has more than doubled laboratory facilities.

The center is housed in a new 3-story addition to the company's Pittsburgh headquarters building. Coupled with the original laboratory space in the main building, the addition gives the department a total working area of almost 14,000 square feet.

The company, a division of *American-Marietta Co.*, is one of the nation's leading producers of protective coatings.

New Toronto Headquarters for Stokes Canadian Subsidiary

F. J. Stokes Co. of Canada, Ltd., Canadian subsidiary of *F. J. Stokes Corp.*, Philadelphia, has moved its Toronto headquarters to 4198 Dundas St. West. Telephone number of the new office is Belmont 2-2301.

Fred Y. Walters is manager of the Canadian company.

Engelberg Names Kreager Sales Manager

James D. Kreager has been promoted to the position of sales manager of *Engelberg Huller Co., Inc., Abrasive Machine Division*. In his new post, Kreager will direct and coordinate all activities of the nationwide sales force and will make his headquarters at the home office in Syracuse, N. Y.

Kreager has been west coast sales

James D. Kreager

representative for the company for more than three years. Prior to joining the firm, he was associated with the Fred C. Poulsen Co. of Los Angeles as a machinery salesman and attended Compton College.

Stanley O'Dette Elected Alsop V. P.

Alsop Engineering Corp., Milldale, Conn., manufacturers of liquid processing equipment, announces that *Stanley R. O'Dette* was elected director and vice president at the annual stockholders' and directors' meetings on January 20, 1958. Mr. O'Dette is also chief engineer and has been since January 1957. All the previous officers were reelected at the same meeting.

Stanley R. O'Dette

Mr. O'Dette recently retired, after 30 years in the petroleum industry, 28 of which were with the Standard Oil Co. of N. J. He is a mechanical engineer and holds chief engineers' licenses for stationary and marine steam and diesel plants. He served as Lieutenant in the U. S. Navy during World War I, and as civilian advisor to the Military during World War II.

Roach Equipment Co. Appointed Trerice Distributor

Roach Equipment Co., Inc., 301 W. 23rd St., Tulsa, has been appointed exclusive distributor of *Trerice* temperature instruments for the State of Oklahoma.

Allied Research Expands Laboratory Staff

To accelerate its program of product development, *Allied Research Products, Inc., Baltimore* manufactuer of finishes for nonferrous metals and plating chemicals, has announced the addition of three new men to its laboratory staff.

John A. Henricks is now associated with the firm as a development engineer. His previous associations include the Formea Co., duPont, Tanner Chemical and Detrex Corp..

Leonard Averbach and *Herbert C. Wagner* have joined the laboratory staff as technicians. Mr. Averbach was formerly associated with The Maryland Cup Co. and Mr. Wagner with the Baltimore Paint and Color Works.

Cowles Promotes Swift

Cowles Chemical Co., Cleveland, Ohio, announces the promotion of *William R. Swift* to assistant sales man-

DEPENDABLE PPI PRODUCTS

PLATING RACKS
RUBBER DRUM LINERS
ACID CONTAINERS
ANODE HOOKS
FIBERGLAS TANKS
DUCTS & HOODS
PLASTIC COATED DIPPERS & PAILS
STEEL & STAINLESS STEEL TANKS
LEAD & PLASTIC LINED TANKS
POLYETHYLENE PAILS & CONTAINERS
FUME SEPARATORS
PLATE COILS
LEAD ANODES
DEGREASING SOLVENTS
SILVER BRIGHTENER

SAVE ON NICKEL USAGE . . . with PPI UZALL ANODE HOOKS . . . .

Uzall Anode Hooks are made of 3/8 in. Square Monel or Nickel plated Steel — then Plastisol coated. These hooks are furnished with rubber anode protectors. Uzall Hooks can be supplied in length sizes from 4 in. thru 8 in.

ADVANTAGES:

- Conserves on nickel usage
- Cuts down on nickel scrap
- Hook can be used over and over again because it is protected by a plastisol coating
- The rubber anode protector protects hook threads from corrosion and current attack

Plain PPI Anode Hooks

Furnished in all sizes 3 in. thru 8 in. (1 in. length increments)
Steel — Copper — *Monel

*Monel Hooks subject to availability of material

Prices Quoted Upon Request

PLATING PRODUCTS, Inc.
1509 N. WASHINGTON
KOKOMO, INDIANA

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William R. Swift

Donald G. Dutcher

ager, metal finishing chemicals department. In his new position, Swift will work directly under *C. C. Clabaugh*, manager of the department and will handle the direction of field activities of the department in the sales and servicing of the firms electrocleaners, zinc phosphate coatings, and the other metal finishing chemicals.

Swift is a graduate of General Motors Institute and came with Cowles in 1956 after an extensive background in the sale and servicing of metal finishing chemicals. He makes his headquarters at the company's main office in Cleveland, Ohio.

Federated Metals Names Mackan Cleveland District Manager

A. J. Mackan has been appointed Cleveland district sales manager for *Federated Metals Division* of *American Smelting and Refining Co.* He has been with the division since 1946. During the war, Mr. Mackan worked in personnel administration for the War Department. Prior to that, he spent several years in the finance business.

Mr. Mackan is a 1935 graduate of Ohio State University where he studied business administration.

Dutcher Appointed H-VW-M Chief Electrical Engineer

Donald G. Dutcher has joined *Hanson-Van-Winkle-Munning Co.* as chief electrical engineer. Design of the firm's complete line of electrical equipment has been centralized under Mr. Dutcher, whose experience covers the design and manufacture of a wide variety of automatic controls and electrical motors.

A graduate of the State University of Iowa, with a degree in electrical engineering, Mr. Dutcher previously held the position of chief electrical engineer with W. F. and John Barnes Co. and Ipsen Industries.

General Manager and Sales Manager Appointed for NCR Equipment

James H. Moore has been named general manager of *NRC Equipment Corp.*, a subsidiary of *National Research Corp.* Also appointed is *Harry D. Stone* of Akron, O., who becomes sales manager.

Mr. Moore was the first general manager of Vacuum Metals Corp., Division of Crucible Steel Co. of America. This company was organized by National Research and jointly owned with Crucible for several years. Previously Mr. Moore had directed metallurgy development at NRC. He received his degree in metallurgy at Massachusetts Institute of Technology in 1940, and completed additional graduate work at M.I.T. and Carnegie Institute of Technology.

Mr. Stone joined the firm in 1954 and was made manager of vacuum equipment sales in the Cleveland area. He was a major in the Air Force during World War II and is a 1948 graduate of the Harvard Business School.

New Appointments at Kelite

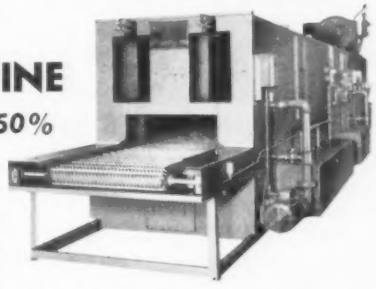
George S. Johnson and *Robert G. Hazel* have been promoted to district sales manager by *Kelite Corp.*, manufacturers of industrial chemicals and steam cleaning equipment.

Mr. Johnson has served for seven years in personnel work at the Chicago facility, and as sales supervisor and sales engineer. He is a member of the A.E.S. He will be in charge of sales in the Indianapolis district, of the Midwestern Region. His headquarters will be in Indianapolis, where he resides.

Mr. Hazel joined the firm in February, 1957 as a sales engineer. Prior to that time, he served as a maintenance supervisor at the Port Arthur, Texas refinery of the Gulf Oil Co. He will be in charge of sales in the Beaumont District, with headquarters in Beaumont, Texas. He is a resident of Port Arthur, Texas.

NEW A-F "3-in-1" WASHING MACHINE

Cuts Metal Cleaning Costs 50%



Two A-F Overhead Conveyors and an A-F Flat Wire Mesh Belt Conveyor carry parts through this new A-F "3-in-1" Washing Machine . . . and on to subsequent operations *without costly rehandling!* For example, one conveyor might take parts directly to assembly, another to painting. Conveyors can be operated simultaneously or independently.

Using common tanks, spray systems, headers and drains, this new A-F "3-in-1" Washing Machine saves more than 50% — in first cost, and in operating and maintenance costs — over separate machines.

Write today for FREE 28-page illustrated brochure.

A-F *ENGINEERED* Cleaning and Finishing Machines

Plant-Wide Conveying Systems

Pre-Engineered Conveyors—Rollers, Wheel, Belt, Trolley

THE ALVEY-FERGUSON CO., 500 Disney St., CINCINNATI 9, OHIO and Azusa, California

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George S. Johnson

Robert G. Hazel

Vincent E. Bowes

Vincent E. Bowes has been promoted to Midwestern regional sales manager. He joined the company in February, 1957 as petroleum service manager. Prior to that, Mr. Bowes was associated with Oakite Products, Inc., for 11 years. For 7 years, he served as manager of Oakite's petroleum service division. Earlier, he held engineering and administrative positions with Consolidated Edison, New York.

Mr. Bowes will be in charge of sales in Illinois, Indiana, Iowa, northern Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, Wisconsin, and North and South Dakota. He will make his headquarters at the manufacturing facility in Chicago.

Appointments Announced by Eastman Chemical

A reorganization of the field sales activities of the *Chemical Division* of *Eastman Chemical Products, Inc.*, into three regional areas and the appointment of regional sales managers have been announced recently.

The newly appointed regional sales

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.

Complete Service for Metal Finishing

Products Listed Below Available in New York Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds
Brushes
Buffs
Chemicals
Tripoli Comp.
Acme White Finish
Tallow
Rouge
Emery Paste
Cleaners
Emery
Glue
Nickel Salts
Copper Salts
Cyanide
Tanks, All Kinds
Plating Barrels
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195 LAFAYETTE ST., COR. BROOME

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FILTERS

MAIZO Drying Materials

LEA Buffing & Polishing PRODUCTS

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IT'S EASY TO STRIP OFF PAINT and Solve Your Stripping Problems with —

EPOXYSTRIP

PAINT STRIPPER — Saves Time and Money!

A new more powerful paint stripper that outstrips all others! No organic finishes have yet resisted this amazing paint stripper. It was especially formulated to remove epoxies . . . with the same ease that it removes baked enamels, lacquers, etc. No stripping scum—clean rinsing!

SEND FOR FREE BROCHURE

- EPOXYSTRIP WILL NOT HARM SOFT METALS
- ECONOMICAL — MORE JOBS PER GALLON AT LOWER COST
- NO SCRUBBING OR MANUAL ASSISTANCE
- RECOMMENDED BY LEADING FINISH MANUFACTURERS

JOBBERS: Beck EPOXYSTRIP sells on demonstration. Try it and see for yourself.

BECK EQUIPMENT COMPANY

3350 WEST 137th STREET — CLEVELAND II, OHIO

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Robert H. Cannon

John H. Sanders

Decator B. Campbell, Jr.

managers include *Robert H. Cannon* who has been in charge of the division's New York office for the past several years. Cannon will now direct the sales of chemicals and dyes in the New England and Middle Atlantic states including the operation of the company's distribution center at Lodi, N. J.

John H. Sanders becomes regional sales manager for those areas served by the division's Cleveland, Cincinnati and Greensboro, N. C. offices plus other areas of the south and southwest. He was formerly in charge of the division's Cleveland office and, more recently, product manager for all chemicals produced at Kodak's Texas Eastman Co. division.

Decatur B. Campbell, Jr. has been appointed regional sales manager of the mid-western area and as such will direct the sales of the division's products in those areas served by the company's Chicago, St. Louis and Houston offices. Prior to the new appointment Campbell was in charge of the division's Chicago office.

NUGLU

THE IDEAL ADHESIVE

For Setting Up or Recoating Polishing Wheels, Abrasive Belts & Discs

Nuglu, a liquid glue, developed to lengthen wheel life — produce a better finish, and increase metal finishing production.

BRUSHING NUGLU

A mixture of Nuglu and graded aluminum oxide grain —

Save on operating costs, **increase** production, **reduce** wheel inventories, and obtain **greater** results, with **less** costly materials, in fine polishing work!

Ask for information on The Siefen Finishing Systems — Also for better metal finishing use Siefen Compositions • Stainless Steel • Bar (Grease) in Tube • Liquid Tripoli • Liquid Grease • Lapping Compound • Burring Compound.

Siefen For Service

J. J. SIEFEN CO.

5643 LAUDERDALE, DETROIT, MICH.

1927 Our Thirtieth Anniversary 1957

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AGATEEN

All you "GUYS and DOLLS" in the AES

are cordially invited to visit our Hospitality Headquarters at the Gibson Hotel in Cincinnati during the Annual Convention of the American Electroplaters Society. Will greet you there in person.

BILL CHACE

AGATE LACQUER MANUFACTURING CO., INC.

SERVING INDUSTRY SINCE 1927

11-13 43rd Road

Long Island City, N. Y.

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AGATEEN

THE LAST WORD IN QUALITY

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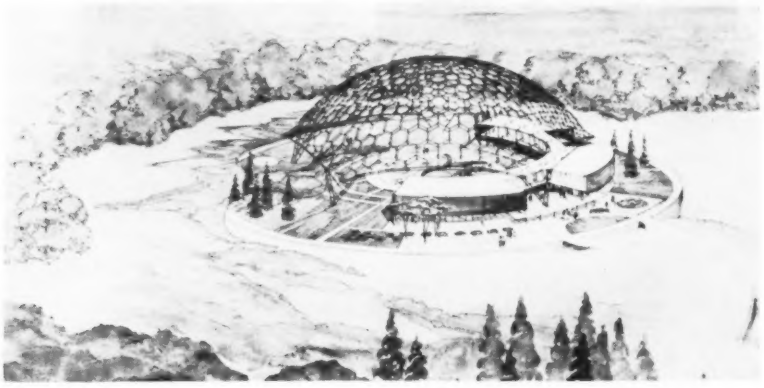
American Society For Metals To Build New Quarters



The new headquarters building designed for the American Society for Metals features an aluminum geodesic dome, or "space lattice", (250' x 103'), a semi-circular concrete and steel building in three levels, and a 400 foot diameter garden piazza.

A $2,000,000 project, the new structure will be located east of Cleveland in Russell and Newbury Townships. It is to be built on a 100-acre rural site with a long western view towards Cleveland. A great variety of metals will go into its construction.

Du Pont To Construct New Manufacturing Unit

A unit for the manufacture of two new polyvinyl acetate emulsions will be constructed at the Toledo, Ohio, plant of *Du Pont's Electrochemicals Department*, it has been announced. The two new products are water-resistant, extremely small particle-size emulsions designed primarily for use in water-base paints. They will be sold under the designation "Elvacet" which is the firm's trademark for its polyvinyl acetate emulsions.

The new unit at Toledo is expected to be completed early in December. Meanwhile, semi-commercial quantities of both products will be furnished from the Niagara Falls, N. Y., plant. Construction of the Toledo unit will increase employment at the Electrochemicals plant by 16 men.

Hokanson Joins Mearl Corp.

Elmer N. Hokanson, formerly with the Arlington Works of E. I. duPont De Nemours & Co., has joined *The Mearl Corp.*, New York, producers of natural and synthetic pearl essence. In his new position, Mr. Hokanson will be responsible for product application and development work, and, will be available for consultation by users.

H-VW-M Announces Reorganization of Engineering Division

A major reorganization of its engineering division has been announced by *Hanson-Van Winkle-Munning Co.* A company spokesman described the changes as reflecting a basic approach to product and systems research and development. Under the new program, greater emphasis will be placed on development of new and improved methods in the anodizing and electroplating fields. In addition, increased research in the field of new products and equipment is planned.

To implement the increased emphasis on research and development, the company is building new mechanical and electrical laboratory facilities and expanding facilities of its electrochemical laboratory.

Bureau of Ships Announcement on Cost Allocation

It is the intent of the Bureau of Ships to change the cost allocation of qualification tests for Specification MIL-P-0020218B(SHIPS), Plating, Chromium, Electro-Deposited, Porous. The terminal date for tests at Government expense is 5 August 1958. Qualification tests requested after that date will be at the expense of the manufacturer.

Copies of the specification may be obtained from the Commanding Officer, Naval Supply Depot, Scotia 2, N. Y.

THE MASTERS' ELECTRO-PLATING ASSOCIATION
of NEW YORK, INC.
59 EAST FOURTH STREET, NEW YORK 3, NEW YORK

PROUDLY ANNOUNCES ITS

40th Annual

Banquet and Entertainment

SATURDAY, JUNE FOURTEENTH
NINETEEN FIFTY EIGHT

ASTOR HOTEL
NEW YORK CITY

Subscription
$25.00 per person

Cocktails at 6:30
Dress optional

News from California

By Fred A. Herr

Alan Baker Co., distributors of electroplating equipment and supplies, recently moved from 10 Bluxome St., San Francisco, to spacious new quarters at 180 Sylvester Road, South San Francisco, Calif. *Alan Baker*, president, reports that the new facilities provide

the firm with 15,000 square feet of floor area for offices, warehouse and production space for rebuilding and testing equipment.

The newly constructed one-story building is of the tiltup design, single-span construction and is surrounded by liberal amounts of outdoor parking and storage areas. The plant is served by a railroad spur track, has dock-high loading facilities and the latest type of equipment for handling large and heavy machinery items.

The sales operations of this comparatively new and vigorously operated firm cover the entire United States, Canada and Mexico and export business overseas.

H. R. Smallman, until recently manager of the Hanson-Van Winkle-Munning Co. branch in Los Angeles, has transferred to the executive and sales engineering staff of Alert Supply Co.'s San Francisco branch.

Mr. Smallman served H-VW-M in Los Angeles until the firm, on February 1, acquired Alert Supply, which it is now operating as a subsidiary. In San Francisco Mr. Smallman will be associated with *Jack Hodges* who, for several years, has directed the affairs of Alert's Bay District office at 925 Harrison St., San Francisco.

Richard T. Coen, formerly manager of the San Francisco branch of the L. H. Butcher Co., recently was named manager of the Metal Finishing Department of the E. S. Browning Co., whose operations are centered at 1515 Third St., San Francisco. Coen reports that the plating division has been expanded so that it now offers a complete line of metal finishing supplies and equipment. Coen is a past-president of San Francisco Branch A.E.S.

Mitchell Raskin, who for 12 years was instructor of a course in electroplating sponsored by the University of California Extension Division, has accepted the instructorship of a plating course approved and recommended by the A.E.S., which is being held at Woodbury College, 1027 Wilshire Blvd., Los Angeles.

The course, which began February 18, will consist of 20 weekly sessions (Tuesdays from 7 to 9:30 p.m.), including four field trips. Prospective students are permitted to attend the first two sessions without payment of fee to determine if they wish to continue with the entire course.

Representatives of 125 firms operating in the North Hollywood, Calif., area met in Northridge, Calif., recently, to discuss methods of expediting requirements of contracting companies in respect to specifications, quality, delivery and other phases of relations of metal working and metal finishing firms with prime contractors.

Referred to as a Procurement Conference, the gathering was sponsored by the North Hollywood Chamber of Commerce. Many of the firms displayed their products in booths set up on the grounds of the San Francisco Valley Fairgrounds. Represented at the conference and exhibit were manufacturers in the fields of electronics, aviation, missile construction, metal finishing, fabrication and forming, machine tooling, heat treating, engineering and related fields.

A controlling interest in Titanium Fabricators, Inc. of Burbank, Calif., is reported to have been acquired by the Santa Fe Western Corp. of Albuquerque, N. M. The re-aligned board of directors of Titanium Fabricators is composed of *O. M. Bell*, president; *Paul T. Wilson*, *C. N. Rees*, *Harvey L. Karp*, *Fred Spiegl*, *H. O. Van Petten*, and *Morris Asimow*. Spiegl and Wilson were named vice-presidents, and Van Patten secretary.

Edward P. Russell has been named western division manager for the Chainveyor Corp. of Los Angeles, with headquarters at the Los Angeles office of the firm. He had served since 1955 as project engineering manager for the firm, and has a background of many years in the materials handling and conveyor field.

Aluminum Co. of America recently opened a branch office in San Diego, Calif., with *R. A. Hutchinson, Jr.*, as branch manager. The new branch, which is under Alcoa's Los Angeles district office, is located at 2962 Fifth Ave., San Diego.

An expansion of his plant facilities at 7550 Melrose Ave., Los Angeles, is reported by *Jack Schultz*, head of Jax Products, Southern California manufacturer and distributor of plating chemicals and supplies.

Jack reports that a laboratory has been installed with facilities for making titrations, and that a 25,000 square foot warehouse has been acquired, which brings the total floor area to 33,000 square feet. *Noel Stark*, formerly West Coast representative in Los Angeles for the Promat Div. of Poor & Co., has been named technical adviser and laboratory director.

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Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Plans are nearing completion for the 45th Annual Convention of the American Electroplaters' Society, to be held in Cincinnati, May 18-22. Nearby branches that have been cooperating for the past four years to put on a tri-state annual regional meeting will instead put all their efforts this year into promoting the annual convention. These branches are Indianapolis, Columbus, Dayton, Cincinnati and Louisville. *L. A. Critchfield* is the coordination chairman for assigning days at the convention which will be sponsored by each of these branches. Headquarters hotel is the Sheraton-Gibson.

A panel session is scheduled for Thursday, May 22nd with specialists on—

Preparation of Metals for Plating

Fountain Square

Corrosion and Its Prevention
Conversion Coatings
Plating for Military Requirements
Anodizing
Plating on Aluminum
Decorative Plating
Job Shop and Specialty Plating

Questions can be submitted to the panel whether you are planning to attend the convention or not. *R. L. Winston* of The Electric Auto-Lite Company, Sharonville Division, Cincinnati 41, Ohio, is chairman of this panel session, which is entitled "Stump the Experts!!"

Children accompanied by their parents will be welcome at the social functions of the convention and a schedule of ticket prices for children (under 16) has been established —

A.E.S. Annual Outing at Coney Island—$2.50
Wednesday evening floor show and dance—$2.50
Thursday evening Annual Banquet & Dance—$7.50.

Ray Barry is in charge of a visit to the Ivorydale plant of the Proctor & Gamble Company. Convention visitors and their wives are eligible for this trip to the largest soap works in the world which is scheduled for Wednesday afternoon and will include a viewing of the following operations — kettle room, milling, packing, control laboratory and edible fats (Crisco and Fluffo).

For further information about the technical program, write to *L. J. Howald*, The Harshaw Chemical Company, 6265 Waihe Road, Cincinnati 13, Ohio

Requests for hotel reservations should be sent to Cincinnati Convention and Visitors Bureau, Inc. Union Cen-

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Late arrivals to the convention can save time by taking *helicopter* from the Greater Cincinnati Airport to Headquarters Hotel.

This six minute ride will give a nice introduction to this historic Ohio River city. The downtown terminal is about one block from the Sheraton-Gibson Hotel, headquarters for the Convention.

Fare is approximately $8.00 per person.

If you wish to use this service on arrival, it is suggested that the Airline Ticket office be requested to ask for reservation.

Ohio Valley Airways, Inc. operates this helicopter service and has a good safety record. Mr. Campbell has offered two free rides, and a drawing will be made at the Convention to determine the lucky people.

Don't delay—make your reservation *NOW*.

L. J. Howald
Publicity Chairman

Rochester Branch

The Fourth Annual Empire State Regional Conference of the A.E.S. will be held in Rochester, N. Y. on April 19, 1958. Approximately 500 specialists in the electroplating field and related industries are expected to attend. Delegations will come from Buffalo, Syracuse, Utica, Albany, and the Southern Tier.

Frank O. Beuckman, Eastman Kodak Co. development engineer and president of the Rochester Branch, is general chairman of the conference.

A program of six technical papers on metal and organic finishing will be presented during the afternoon at the Hotel Manger, conference headquarters. A banquet at the hotel is scheduled for the evening.

The three speakers and topics at the plating education session will be *Clarence Sample*, International Nickel Co.—"Performance of Multiple Nickel Coatings", *Paul Talmey*, Kanigen Div. G.A.T.—"Practical Applications of the Kanigen Process", and *Morris Tardiff*, Hanson-Van Winkle-Munning Co. —"Choice and Specification of Materials for the Plating Room." *William Tucker*, Eastman Kodak Co., will be chairman of this session.

The simultaneous Organic Finishing education session will feature papers on: "Pretreatment of Metals for Organic Finishing" by *Gerry Lux*, Oakite Products, the latest Interchemical movie on color plus discussion by *P. O. Blackmore* of Interchemical and "Equipment for Pretreatments and Organic Finishing by a representative of the DeVilbiss Co.

Lancaster Branch

The regular meeting of the Branch took place on February 14, 1958, at the Old Mill Inn, Lancaster, Pa., with twenty-four members present on a very cold and windy evening.

One new member, *Merrel Darr*, was elected to membership, during the business meeting. The secretary reported with deep regret the passing of branch member *Oscar Border* of York, Pa.

A brief discussion was held concerning the plight of job platers and manufacturers with respect to the applica-

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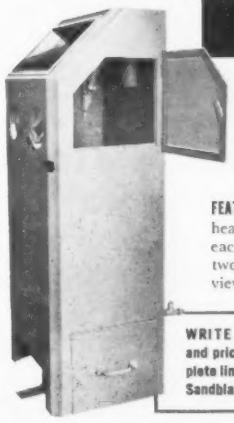

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tion of certain aspects of the Pennsylvania Use Tax. *Lewis Briggs* of the Erie Plating Co., Erie, Pa., has written to Pennsylvania branches to inform other A.E.S. members of the results of hearings held in Harrisburg.

William Jackson of the Udylite Corp. was introduced by *Charles Boll*, local representative. Mr. Jackson gave an interesting talk on the subject of barrel plating and processing equipment.

The meeting adjourned after enjoying a buffet lunch at the Old Mill.

Waterbury Branch

The February meeting was held on Thursday, Feb. 13, at the Roger Smith Hotel. This meeting was designated as "Sustaining Members' Night." About 70 members and guests were on hand and were well pleased with the talk given by guest speaker *Walter L. Pinner*. His subject was "Accelerated Corrosion Tests." National President *Frank Eddy* made a few remarks concerning the research program and turned the meeting over to *Ray Mitchell*, chairman of Sustaining Members' Committee. Mr. Pinner spoke about the need for a new accelerated test and explained in detail how the Korrodkote or Formula 59 had been attained. He mentioned that, in the near future, this formula would generally be accepted by the industry.

Nicholas Topazio
Publicity Dir.

Milwaukee Branch

The Annual Banquet and Educational Session of the Milwaukee Branch will be held Saturday, April 26th, at the Hotel Schroeder, Milwaukee, Wis. The educational session starts at 9:30 A.M., with the theme: "The Challenge of Outer Space."

John P. Nichols, executive secretary of the Society, and managing editor of *Plating* magazine, will be the guest luncheon speaker.

For the educational sessions the group will be addressed by: *Harold Mueller*, chief process engineer, A C Spark Plug Div. of General Motors Corp., Milwaukee. "The Precision Cleaning and Deburring of Missile Guidance Components."

Dr. Donald Swalheim, Research Laboratory, Electrical Chemical Div., Dupont. "Recent Developments in Copper Plating."

Milton A. Glaser, vice president and technical director of Midland Industrial Finishes Co., "Modern Organic Finishes for High Temperature and Abrasive Protection."

Blue Ridge Branch

The Blue Ridge Branch held its monthly meeting at the Baptist Hospital Cafeteria in Winston-Salem, N. C., 6:00 p.m., February 7, 1958 with *T. R. Boggess* presiding.

Howard Welfare reported that plans for Southeastern meeting were completed and that if reservations were not obtainable there would be help available to secure lodging nearby. *Carl Witherspoon* reported that the Branch's application for a permanent charter had been approved and a meeting would be held March 28 at Roanoke, Va., for presentation by National President *Francis T. Eddy* and Secretary *John P. Nichols*. *Nelson F. Murphy* announced that associate memberships would be extended to mem-

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bers of other branches. *Fred Fulforth* and *Richard R. Russel* of Atlanta Branch were elected as associate members.

Eugene O. Eagle introduced *Ed Kubis* who gave an illustrated lecture on cleaning cycles for all types of base metals in preparation for plating. Mr. Kubis is national industrial sales manager for Wyandotte Chemical Corp. Techniques for cleanliness testing, trouble shooting and rinsing were discussed.

Carl A. Witherspoon
Secretary-Treasurer

Chicago Branch

On Saturday, January 25th, the Branch held the annual banquet and educational session at the Conrad Hilton Hotel. The banquet committee did a highly commendable job in all phases of the arrangements. The first speaker at the afternoon session was *Dr. Neal Berst*, director of research, Diversey Corp. who gave a talk on "Deep Etching."

Charles McCann, assistant to the director of Social Research, Inc., gave a talk on "The Importance of Finishing and Packaging in Selling."

Harry A. Evangelides, research metallurgist at Frankfort Arsenal discussed "The H.A.E. Process for the Treatment of Magnesium."

The February meeting of the Branch was held at the Western Society of Engineers on Friday, Feb. 7, 1958. The guest speaker for the evening was *E. M. Battey*, whose subject was "Waste Treatment in the Metal Trades." Mr. Battey, district manager of Infilco, Inc., pointed out the serious need of plating plants to treat their wastes to prevent pollution and contamination.

A film showed the various treatment plants and equipment necessary to reduce wastes to a suitable level as required by the public pollution control authorities. A question and answer period followed the showing of the film.

C. Marzano
Publicity Chairman

Detroit Branch

The largest attendance in a good many meetings overflowed the Michigan Room of the Statler Hotel for the annual OLD TIMERS' NIGHT held on Friday, Feb. 7. It must have been gratifying for the lecture series committee under *Fred Brune* to behold the fine turnout for the Symposium—Performance of Plating on Automobiles presented by representatives of the Big 3 automotive manufacturers.

The meeting was opened by *Glenn Friedt, Jr.*, president, who welcomed the numerous members and guests. *Manuel Ben*, 1st vice president and chairman of the membership committee, introduced 20 candidates for membership and 6 transferers from other branches. With their election the branch membership totals 745—a new record.

Doug Thomas introduced the speakers in order of appearance. Messrs. *G. G. Levy*, Chrysler Corp.; *V. Cassidy*, Ford Motor Co. and *H. A. Kahler* of General Motors Corp.

Mr. Levy discussed the trim parts which are plated on an automobile. He illustrated, by means of chart slides, the results of studies which disclosed

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quite a variance in the life of plated parts and the durability of the plated surface on different basis metals.

Mr. Cassidy, gave a graphic illustration of the increasing amount of trim parts which are plated on automobiles down through the years by use of slides. He described a test for trim part corrosion, conducted by Ford on automobiles which were subject to the atmosphere of the Rouge Plant area for varying lengths of times. It illustrated, very completely, the effect of various atmosphere on plated surfaces and pointed out the great importance of keeping plated surfaces clean by having frequent car washes.

The third speaker, Mr. Kahler, gave an enlightening talk on the manner by which the company collects charts, analyzes and evaluates the data on corrosion of plated trim parts.

There was a short question-answer period and the meeting adjourned with refreshments at 10 p.m.

Toronto Branch

The February meeting of the Toronto Branch was held in the "Royal York Hotel" on Friday the 14th, and 50 members left their Valentines at home and sat down to dinner. *Bob Edwards*, president; *Roal Clark*, secretary; and *Gordon Lince*, treasurer, all were elected by acclamation.

The speaker, *F. A. Voege*, was introduced by *Bert Barraclough* of Triangle Conduit & Cable. The topic: "Industrial Wastes in Ontario." The Ontario Water Resources Bill has just been in effect since June 1957. The question period was quite lively, *Art Severs*, Severs Enterprises, insisted on an answer to how much teeth the act had. This prompted *Pat Patterson* (job shop owner) to insist that we really did not want the commission to show its teeth so much but, rather, what we could do so as not to provoke an investigation into the plating shops.

Vice president *Ray Day* thanked the speaker and assured him the A.E.S. Toronto Branch would co-operate in every way. *Bernie Teal* of Westinghouse, Hamilton, Ontario, invited the Toronto Branch to their meeting February 22nd.

The meeting adjourned at 10:00 p.m. Refreshments and cards were enjoyed by all.

A. W. Wilson
Librarian

Western Ontario Branch

The January meeting was replaced by the annual Ladies Nite Dinner-Dance. Many friends from the other Ontario Branches joined in an evening of good fellowship. The February meeting was held on Friday, Feb. 21st, at the Wm. Pitt Hotel in Chatham. Present were twenty-three members and guests.

President *Earl Patterson* read a letter from the research committee, thanking the Branch for its contribution to the research fund.

Secretary *Art Campbell* introduced a new suggestion system to the Branch. Forms were passed out during the dinner and were collected prior to the meeting. This system should prove stimulating and valuable. The first suggestion came from *Alex. Corbit*— That we attempt to have an officer from the Supreme Society attend a meeting, to speak on the purpose and objectives of the A.E.S. Many of the members

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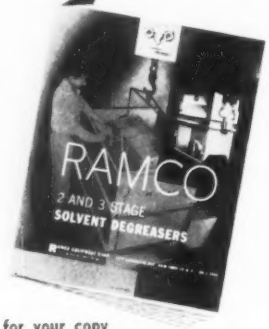

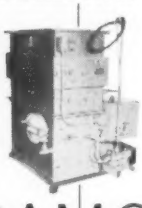

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are unable to attend the annual conventions and, possibly, do not fully realize the true scope and value of the society.

Les Crooks suggested that we hold our May meeting in London, Ontario. Several years ago *Alex. Corbit* did an excellent job of arranging a London meeting. He was again commandeered for the job.

The speaker for the evening was *John D. Winters*, Incar Ltd., Cleveland, Ohio, whose subject was, "Cyanide Zinc and Cadmium Plating. Problems, Causes and Solutions." Mr. Winters gave many practical suggestions for the efficient operation of these plating baths.

The usual social session followed the meeting.

D. R. Mainland
Vice President

Los Angeles Branch

Members of Los Angeles Branch were given an outline of practices and regulatory requirements respecting treatment and disposal of waste in plating plants from four different angles at the branch's February 12 meeting in Rodger Young Auditorium, Los Angeles.

Librarian *Frank Virgil* presented a panel discussion during which waste treatment was discussed from the water conditioning standpoint, the viewpoint of the job shop owner and the operator of a large industrial finishing department, and from the municipal regulation aspect.

The panel consisted of *Sidney Solomon* of the Water Conditioning Co., who served as moderator; *Robert Coombs* of Crown City Plating Co.; *Royce Griffith* of Aero-Jet General Corp.; and *George A. Bell*, sanitation engineer of the city of Los Angeles.

Mr. Solomon pointed out that treatment of plating shop waste is a necessity and not an operation that will bring any profit to the plating shop owner. Mr. Bell explained the requirements pertaining to waste disposal in the city of Los Angeles. Mr. Griffith gave the members an idea of the scope of waste treatment facilities when he described the equipment installed in the Fort Crockett Rocket Plant near Neosha, Mo.

Solomon and Coombs discussed various methods for treating plating plant waste water, including ways of treating badly contaminated materials so that they can still be used for less important functions in the shop.

Branch President *George Magurean* welcomed three new members into the Society, *William O'Mara*, *Lincoln Lowe* and *Gilbert Bishop*. Bishop was reinstated after dropping out for several years to engage in deep-sea fishing in Long Beach. Guests attending the February 12 meeting included *Jack Montgomery* and *Del Austin* of Modern Plating Co.; *G. Perrin* of Northrup Aviation; *Paul Schlocker* of F. C. Wolfe Co.; *Robert D. Martin*, of Alert Supply Co.; *William Ryan* of Douglas Aircraft; and *John Amos* of Anchor Fence Post Co.

President Magurean reported that National President *Francis T. Eddy* of Thomaston, Conn., would visit Southern California in April. Since Mr. Eddy's visit will not coincide with the

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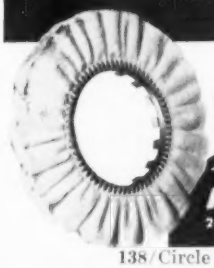

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branch's regular monthly meeting, a special meeting will be arranged to permit Los Angeles members to meet and hear the Supreme Society official.

Grand Rapids Branch News

The Twentieth Annual Educational Session and Dinner Dance was held Saturday, February 15 at the Pantlind Hotel in Grand Rapids. Approximately 110 members and guests attended the educational session which got underway at 10:30 A.M. with the educational chairman, *Orville Hoxie*, introducing the first speaker, *George Bruggink*, Grand Rapids City Engineer. His topic was "Metropolitan Aspects of Waste Control." Following Mr. Bruggink's talk *"Chet" Harvey*, area representative of the State of Michigan Water Resources Commission was introduced. His topic was "State Approach to Pollution Control."

Following Mr. Harvey's talk luncheon was served in the Kent State Room. Frederic B. Stevens, Inc. was the host at the luncheon. Distinguished guests were *Ralph "Duke" Wysong*, 2nd vice-president of the Supreme Society from South Bend, Ind., and *Don Austin*, member of the Supreme Society editorial board from Detroit.

Following luncheon the group strayed from the field of electroplating and listened to a talk by *"Less" Lear*, contract engineer with Lear Inc. on "Rockets, Missiles and Pertaining Facts."

The evening's festivities got underway in the Grand Ball Room at 7 P.M. with the banquet. There were 500 members and guests in attendance and a good time was had by all. General chairman of the event was *Paul Waalkes*, 1st vice president of the branch.

Don Smith
Publicity Chairman

Louisville Branch

The regular monthly meeting of the Louisville Branch was held on Thursday, Feb. 20, at Hasenour's Dining and Cocktail Lounge, 1023 Barrett St., Louisville, Ky. Dinner was served at 6:30 P.M., and the business meeting followed at 8:00 P.M. Thirty members and guests were present.

Allen D. Russell, Victor L. Baltzell, and *Arthur A. Oertel* volunteered to assist the Educational Chairman at the National Convention on behalf of this branch.

There being no further business, the meeting was turned over to Librarian *Kenneth C. Reifsteck*, who introduced the speaker for the evening, *Thad Peake* of Reliance Varnish Co., Louisville, Ky. Mr. Peake delivered a very informative talk on organic finishing. He discussed various types of paints, enamels, and lacquers with regard to where they should be used, and the various methods of application. He described quality checks used in the industry, and told us about some of the newer finishes. A question and answer session followed, and Mr. Peake was heartedly applauded for a very worthwhile presentation.

The meeting was adjourned at 10:00 P.M.

Frank E. Wilcher, Jr.
Secretary-Treasurer

British Columbia Branch

The general meeting on Feb. 24 was held at the White Spot Dining Room, 25th & Cambie Sts., 28 members and guests were present.

Pres. *Bill Marquardt* read a letter confirming International President *T. Eddy's* visit to Vancouver on April 16, 1958. It was moved by *Ralph Wolloschuk* and seconded by *Claus Schlossareck* that the annual meeting be held at the May meeting.

Pres. Marquardt then introduced the five dinner guests and followed this by introduction of *Prof. W. M. Armstrong* of the Dept. of Metallurgy, U.B.C., who spoke on corrosion. He covered galvanic corrosion then, from this subject, moved to hydrogen embrittlement and residual stresses in metals. Distribution of six pages of notes covering this topic proved an exceptionally good way of remembering the main points of the speaker's subject. The question and answer period was also very well received.

J. Lee
Secretary

Detroit Branch

Circle Saturday, July 26, 1958 on your calendar as a reminder of the Annual Stag Day. It promises to be the most enjoyable entertainment event of the summer season at a brand new location with an 18-hole championship gold course, Olympic size swimming pool, and many other features. Full details to follow.

Newark Branch

William Grigat called the Feb. 21st meeting to order with seventy members in attendance. Secretary *D. G. Foulke* reported on the program of the N. J. Sewage and Industrial Wastes Annual

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meeting of interest to platers. Four applicants were elected to membership: *Frank Dayton* of H-VW-M, *Herman Hammer* of Hill Cross Co., *Louis Marino* of Frederick Gumm Chem. Co., and *Frank Squillaro* of H-VW-M. *William Stoddard* of H-VW-M was accepted as a transfer from Cincinnati Branch.

Robert Ehrhardt introduced the representatives of the sustaining members attending as guests of the branch. *Fred Meyer*, librarian, then introduced *Bob Ehrhardt*, chairman of the research committee. He outlined the philosophy motivating the committee, the contributions of many to the program, including those of Newark Branch who have been active and described the various projects presently active.

Walter Pinner, as the chief speaker of the evening, in his usual capable fashion described in some detail the progress being made by Project No. 15 towards developing a satisfactory method for checking plated coatings by accelerated methods with respect to corrosion. The acetic acid salt spray test, the modification of this test incorporating the addition of copper chloride to the solution and the Corrodkote method were described, as well as the history of the development of these performance test methods. The number of questions and comments attested to the interest and approval of this research project.

D. Gardner Foulke
Secretary

Kansas City Branch

The Kansas City Branch met in regular monthly session Thursday, Feb. 13 at the Berkshire Hotel, in Kansas City, Mo. Thirty-four members and guests completely removed all traces of a family style chicken dinner served a little after 7:00 P.M. At 8:00 P.M. the meeting was called to order by the president, *George Becker*. The treasurer's report was read by *Bill DesJardins* and *Albert C. West*, *Mark P. Odell*, *Bobbie Lee Justice*, *John B. Carduff*, and *John R. Thompson* were elected to membership. Four of the new members being present, were introduced and warmly greeted.

The president appointed *Robert Garrett*, *Glen Wilson*, and *Bob Vandiver* as a committee to make arrangements for the Annual Stag Party to be held sometime during the month of June.

The meeting was turned over to the librarian, *Scott Sterrett*, who announced that the program for the evening was devoted to a presentation by members of the plating department at Trans World Airlines Overhaul Base near Parkville, Mo. *Robert C. Garland*, foreman of the department, presided, assisted by *Tom Sawyer* and *Robert Garrett*. They presented an outline of the design, operation and control of the waste disposal plant in use by their company. Mr. Garland gave figures on the cost of the installation, costs of operation for the past ten months and coordinated the discussion which followed. Mr. Sawyer explained the actual operation of the plant and illustrated his description of the equipment with pictures he had taken. Mr. Garrett discussed the principle of operation and the methods of control used. The three then answered questions on the plant and facts concerning the method used which might be applied to other plants.

Robert L. Garrett

Indianapolis Branch

On Feb. 5, 1958, forty members and guests attended the regular meeting at Fox's Steak House. Vice President *John Hood*, called the meeting to order and led the introductions. *Addison Howard* introduced *Al Prince* of the Dow Chemical Co. for the educational feature, on the subject of Versene as a chelating agent in chemical terms. This chemical complex type is also called EDTA for practical purposes. Using slides and charts Mr. Prince gave us a closer working knowledge of its advantages and limitations. Questions and answers followed which indicated the interest and worth of his lecture.

Three applications for membership with all requirements were presented and accepted: *Paul D. Girt*, *Samuel D. Green*, *George F. Worton*.

John Hood appointed *Roman Bender*, *Bob Bruck* and *Marshall Whitehurst* as a committee to study and review the by-laws in relation to dues, and the new AES by-law requirements.

Les Reynolds asked for branch expression in relation to Tri-State allowing expense for the custodian of funds, when attending national meetings. *Bob Bruck* made a motion that Tri-State delegates be instructed to favor a fixed yearly salary to reimburse the custodian of funds. This motion seconded *by Abe Max*, and carried, and the meeting adjourned 9:40 P.M.

Paul B. Freeman
Secretary

Columbus Branch

The regular monthly meeting was held at Reebs Restaurant on Friday,

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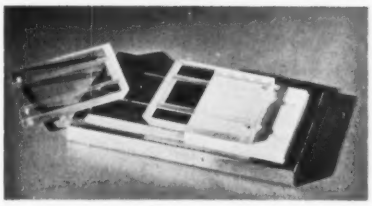

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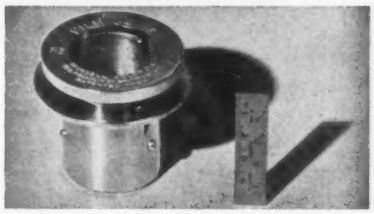

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February 7, 1958 at 6:30 P.M. The business meeting was called to order by President *Calvin Smith*. Candidates *Noble E. Baker*, *Charles T. Brown*, *Richard C. Brown*, *Richard B. Goebner*, *Earl J. Little*, and *John R. Strom* were duly approved and elected as members of the branch. Treasurer *Harry Moore* gave the financial report for the branch and said that everyone had paid their dues for the present fiscal year. Delegate *Bill Neill* reported on the interim meeting held at Indianapolis. He told of the new budget year which will end June 30 instead of March 31. Mr. Neill also reported that the National Society is still operating in the black.

Nate Koslin told of the poor financial condition of the Columbus Technical Council News and said that the CTC News would soon de distributing questionnaires and to be sure to fill them in and return them.

Librarian *Jack Spenard* introduced the speaker of the evening *William Crehan* of Kanigen Division, General American Transportation Corp., whose subject was "Electroless Nickel." Mr. Crehan gave a very interesting talk on the history and the present practice in using the process.

Following a question and answer session, and a round of applause for the speaker, the meeting was adjourned.

Halvor S. Christianson
Secretary

Rochester Branch

The March meeting was held at the Rochester German Club. The meeting was called to order by Pres. *Frank Beuckman*. Business matters discussed were the 4th Annual Empire State Regional Meeting to be held in Rochester on April 19, 1958 at the Hotel Manger, and the budget problem which has been confronting the Branch.

The speaker of the evening was introduced by Librarian *Lorrin Correll*. *P. N. Burkard*, manager of the Industrial, Railroad & Aircraft Depts. of the Wyandotte Chemicals Corp., talked on chemicals and their function in metal cleaners. The process of chemical milling of aluminum, magnesium and steel was presented as well as samples shown of this process on aluminum and magnesium. Mr. Burkard's talk was extremely interesting and most informing on chemicals in use today in the cleaning field of modern electroplating.

Linwood P. Morrison
Sec.-Treas.

Pittsburgh Branch

The February meeting was attended by thirty-five members and guests for dinner. Following dinner, President *Herb Schram* opened the business meeting with roll call of officers. Several communications were read by Secretary *Fred Stevens* and appropriate action recommended on each by the membership. *Ed Smith*, chairman of the nominating committee, presented the slate drawn up by the committee.

Mr. Smith gave a report as one of the Branch's delegates on a ballot sent to him and the other delegates concerning the payment of 15 month per capita tax this year, due to a change in the fiscal year.

Librarian *W. J. Musmanno* presented the evening's speaker, who was *William J. Pierce* of Harshaw Chemical Co. Mr. Pierce discussed the work done on Project 15 and the use of accelerated corrosion testing by the Korrodkote method.

The winner of the free Ladies Night tickets was *Jacques Lussier*, and *Harry Flister* of Wyandotte Chemicals donated them.

Fred Stevens
Secretary

St. Louis Branch

The regular monthly meeting of the St. Louis Branch was held at the York Hotel Wednesday, February 13. When only 20 people were present for dinner it was thought the 10° weather would limit attendance. However, 31 members and guests were present when the business meeting was called to order.

A. P. Julius reported the business discussed at the interim meeting which he and *Robert Coulson* attended at Indianapolis. He said the issue of raising the dues is sure to become a factor at the next business meeting. He mentioned that some branches have successfully organized an Organic Division of their branch. *Craig McAlister* chairman reported that the board of governors had met at his house and discussed the possibility of raising the dues of the St. Louis Branch. They decided the dues should be raised to $12 and Second Vice President *William Piel* made the motion to raise the dues. The motion was seconded by *Frank Menniges*. Many questions followed. A long discussion was held which helped the motion to pass since there weren't any votes in opposition.

At this point Librarian *Ruel Shumway* introduced the speaker of the evening, *Joseph L. Jackson*, head of research & development of R. O. Hull & Co., Cleveland, Ohio. His talk was accompanied by slides. Many questions

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were asked which indicated the interest of the audience. The meeting was adjourned at 10:20.

Ward Kelly
Secretary

AMERICAN ZINC INSTITUTE

The Galvanizers Committee of the steel industry, which is sponsored by the *American Zinc Institute*, will hold its thirty-eighth meeting on April 14-15, 1958 at The Chase-Park Plaza Hotels, St. Louis, Missouri.

N. B. Juster, Inland Steel Co. and *C. T. Mueller*, U. S. Steel Corp., head the program subcommittee for the occasion which will take place concurrently with the annual meeting of the Institute.

CHICAGO ELECTROPLATERS INSTITUTE

Newly elected officers of the Chicago Electro-Platers Institute are: *C. E. Smith*, B. Mercil & Sons Plating Co. and Mercil Plating Equip. Co., chairman; *George Strom*, Ada Plating Works, vice-chairman; and *Louis P. Lanz*, Northwestern Plating Works, secretary-treasurer.

Directors elected at the Annual Meeting are: *Harold W. Baker*, Electro Galvanizing Co.; *R. H. Rahe*, Chromium Corp. of America; *William Bott*, Aetna Plating Works, Inc.; *William Crawford*, Chrome-Rite Co.; *Emil Van Steen*, The Modern Plating Co.; *William Carlson*, Arrow Plating Co.; *Joseph Gruzdis*, Brookline Electro-Platers, Inc.; and *Phil Ritzenthaler*, Plating Engineering Co., West Allis, Wis.

C. E. Smith

The Institute is an association of job shop metal finishing establishments comprising eighty companies in Illinois, Iowa and Wisconsin. The group is in its twenty-third year of operation.

M. F. S. A.

In a letter recently issued to the general membership by *A. P. Munning*, executive secretary, the *Metal Finishing Suppliers' Association* reported on the responses to their letter of January 6th in which they elicited expressions from their membership on their view in connection with the interval and frequency of expositions, which were most enlightening. A large number of replies were in the form of separate letters, some quite lengthy, and many definitely graphic in tone and sentiment.

Eighty firms supplied answers to the three questions asked with results as follows:

Question A—Do you favor an exposition as soon as 1962 after that in 1959?

86.2% answered "No"
12.5% answered "Yes"
1.3% were non-committal

Question B — Did you exhibit in Cleveland?

57.5% answered "Yes"
42.5% answered "No"

Question C—If not, do you now feel that you would support a decision by the Board of Trustees of the M.F.S.A. to oppose such an exposition to the extent of declining to participate?

72.5% answered "Yes"
6.25% answered "No"
6.25% answered with provisions
15.0% were non-committal

Of special significance is the fact that those who answered the questionnaire comprised their oldest and best known members and the ones who occupied most of the space in the 1955 Cleveland Industrial Finishing Show.

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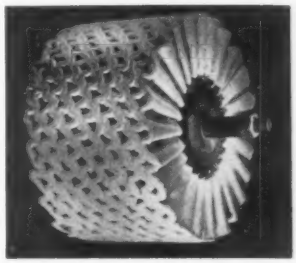

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FEDERATION OF PAINT AND VARNISH PRODUCTION CLUBS

Federation's 36th Annual Meeting and 23rd Paint Show Will Be Held in Cleveland's Public Auditorium

The 36th Annual Meeting and the 23rd Paint Industries' Show of the Federation of Paint and Varnish Production Clubs will be held in Cleveland, Ohio, from October 5-8, 1958, but at a site other than announced at the close of the 35th Annual Meeting in Philadelphia.

Because of the phenomenal increase in attendance at the annual meetings and the demand for space in the Paint Show, both the meetings and the show will be held in the Cleveland Public Auditorium.

This arrangement will please everyone, especially the exhibitors, because the show will be all on one floor and in a space especially designed for exhibit purposes. The technical sessions will be conducted in well-arranged meeting rooms on another floor of the auditorium. The elevator service is both fast and efficient.

Registration will also be in the auditorium and expanded facilities should eliminate the usual registration bottleneck.

Room reservations will be handled by the Cleveland Hotel Registration Bureau but no reservations will be accepted until the official registration form has been made available. No room reservations will be handled through federation headquarters in Philadelphia.

N.A.M.F.

A new local formation in Atlanta, Georgia, February 15, featured the two-day session of the National Association of Metal Finishers' executive committee in that city. Close to two dozen shop owners and firm representatives attended the membership rally at the Dinkler Plaza Hotel. Under the direction of board member *George W. Taylor*, Production Plating Co., Adel, Ga., the rally — a highlight of the current drive for new members — also sparked chances of a local formation in Florida.

Happy faces are those of NAMF members who formed local branch at February 15 membership rally at Atlanta's Dinkler Plaza Hotel. NAMF prexy John Palik, Jr. (third from right) extends congratulations to temporary chairman David J. Griffin. L to r: H. E. Willingham, M. R. McClatchey, H. R. Stogner, Sr., Griffin, Palik, R. Taylor, and E. E. Sprinkle.

Special guests included members of the NAMF executive committee and board of directors who addressed members briefly at a luncheon meeting. *David J. Griffin*, Birmingham Plating Works, Inc., Birmingham, Ala., was elected temporary chairman of the new local.

The new local includes the following members: Southern Plating Co., Inc., Anniston, Ala. *(H. E. Willingham)*; Dixie Plating Co., Inc., Cookeville, Tenn. *(E. E. Sprinkle)*; Atlanta Plating Works, Atlanta *(H. R. Stogner, Sr.)*; Southern Aluminum Finishing Co., Atlanta *(M. R. McClatchey)*; Power Plating, Inc., La Grange, Ga. *(C. N. Shearer)*; Production Plating, Adel, Ga. *(G. & R. Taylor)*; and Birmingham Plating Works, Birmingham, Ala. *(D. J. Griffin)*.

SOCIETY OF VACUUM COATERS

The annual Fall Meeting will be held at the Hotel Statler, Detroit, Mich., on November 5th and 6th, 1958. Those interested in presenting a paper on the technical and practical applications and techniques involved in functional and decorative vapor deposition should send a 100 word abstract as soon as possible to *F. Gruen*, program chairman, Syn-Cote Chemical Corp., Long Island City, N. Y.

Membership application cards can be obtained from *M. Adler*, membership chairman, Society of Vacuum Coaters, P. O. Box 3095, Cleveland 17, Ohio. New members will receive a copy of the 1957 transactions.

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AMERICAN GIANT: 250 amp. - 4000 amp.

ANODIZERS: 5 to 40 volts; 100-3000 amps. all above complete with motors, panel board, starting equipment; separately excited, interpole type.

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INSPECTION INVITED

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ANODIZING • RUSTPROOFING • PLATING • BARREL FINISHING
VACUUM METALIZING • LACQUERING AND ENAMELING

PRICED RIGHT FOR QUICK SALE

1—24" Unichrome Chromium Plating Barrel with solution, blowers etc.
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1—Richardson Allen Rectifier 1000 Amperes 0-6 volts, new stacks with remote control.
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3—Plating Barrels 14" x 24" — 14" x 30" — 14" x 36".
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2—10000/5000 Amp. 9/18 Volt, Chandeysson Motor Generator Sets, with Direct Connected Exciters, Panels and Starters. (1943 Machines) 300 RPM. Excellent Condition.
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1—G. E. 1500 amp. 6 v. MG set.
1—Bogue Generator 3500/1750 amp. 6/12 v.
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1—Control for 4—Udylites.
1—1000 amp. Hobart M.G. set, outside exct.
1—Chandeysson MG set 6 volts.
1—60 v. 750 amp. Star-Kimbal MG set.
1—Rapid 2000/1000 amp. 48/24 volt with new selenium stacks.
1—Green 1000 ampere 6 v. rectifier.
1—Lewis 1000 ampere 6 v. rectifier.
1—Electric Products 400 amp. 24 v.
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1—H.V.W. 5000/2500 6/12 v. Synchronous M.G Set w/controls.

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1—75' Straight Line Extrusion & Rectangular Tubing Polishing Machine w/10 heads, 7-10 H.P. and 3-5 H.P.
5—Acme GI Universal Heads.
31—Murray Way #55 & 60 Heads & Belts Sanders.
11—Acme G-3 144" Belt Sanding Machines.
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2—Acme A-2.
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3—Hammond Double 5 H.P. lathes.
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4—U.S. #95 var. speed 5 H.P. pol. mach.
1—L'Hommedieu Vari-Speed 5 H.P.
15—Pesco & Pesco type 3-5-7½ H.P. pol. lathe.
New Pesco 5 H.P. 385.00, 7½ H.P. $445.00.

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1—Type "S" Production tube polisher, up to 1¼" tubing.

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8—Alsop WR&NR 5" & 7" steel & stainless steel.
1—RDR-2-30x36x30.
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Complete Line Lasalco 14" x 42" cleaning, plating, rinsing, melamine barrels.
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1—Stevens 6 barrel 20' horseshoe type semi-automatic w/6 extra new barrels.
3—#4 Daniels Rubber Lined.

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1—18" Crown Centrifugal.
2—18" Mercil Centrifugals.

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2—Almco 32" x 32" 2 comp.
6—Abbotts 8" x 30", 16" x 30" single & double belt & motor driven.
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2—Globe Tumbling Barrels.
2—Henderson #5 & 5A tumbling barrels.

DEGREASERS
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16—Degreasers 14" to 7', all makes, gas, steam, electric.

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380—Stainless Steel, Steel, Brick, Lead & Rubber Lined, all sizes.

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1—Gas Baking Oven 78" high, 72" deep, 36" wide I.D. w/controls & trucks.
Many other makes & models, of ovens.
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175	14	Delco
200	7½	Chandeysson
300	7½	Hobart
400	60/60	G. E.
750/375	6/12	Excel
940	32	Elec. Prod.
1000/500	6/12	Chandeysson
1500/750	6/12	H-V-W
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
2500/1250	6/12	Elec. Prod.
5000/2500	6/12	Chandeysson
5000/2500	6/12	Columbia
5000/2500	9/18	Chandeysson

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5,000 Amp., 50 mv.
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PLATING MACHINE WANTED
Udylite Cyclemaster (or equivalent) full automatic plating machine suitable for cadmium or zinc plating.
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1—UDYLITE FULLY AUTOMATIC RACK PLATER — FOR ZINC OR CADMIUM. 18 inch rack centers — 38 feet long — 42 inch deep tanks — overall height 8 feet.
3—STEVENS AUTOMATIC BARREL PLATERS MODEL C — 57 barrels per machine. Can redesign to fit your cycle.
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3—7500 ampere, 12/24 volts ELECTRIC PRODUCTS built in 1951. Like new.

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10—UDYLITE STANDARDS 1500/750 amperes 12/24 volts.

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6—Size 18 x 48 x 40, type SCW-2 INDUSTRIAL
3—Size 36 x 36 x 30 SCW-2 INDUSTRIAL
2—RDR-2 36 x 36 x 30 SCW-2 INDUSTRIAL

LARGEST INVENTORY OF AUTOMATIC PLATING MACHINES IN THE COUNTRY.

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SITUATION OPEN — Distributors, jobbers and manufacturers agents wanted to distribute and sell the full line of Schaffner's polishing and buffing composition in bar, spray or paste form, and a complete line of polishing room supplies.

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SITUATION OPEN—Excellent opportunity for salesman presently calling on trade — plating barrel repairs, new barrels; parts all types, gears, panels, doors, bearings, all materials, etc. Address: February 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATIONS OPEN—Salesmen to call on industrial users of paints and general coatings. Men with experience and following preferred. Liberal commission and protected territory to right men. Give full details and references in first letter, also territory desired.

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SALES REPRESENTATIVE or MANUFACTURER'S AGENT

to handle basic metals . . . i.e., anodizing grades of Aluminum, pre-plated and polished steel strip, and other metals for decorative trim or with highly polished surfaces. Key territories open for right men. Give full particulars, background and reference. Address: April 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

DISTRIBUTORS WANTED

Top manufacturer of nickel salts expands production facilities allowing appointment of additional distributors for additional territories. Bonafide distributors to the Metal Finishing Industry please write, giving scope of coverage and other influencing factors, to Box April 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

PLATING SUPERVISOR

SITUATION WANTED—16 years of job shop and manufacturing production plating experience. Also anodizing, dyeing and bright finishes. Analyze all solutions. Excellent chemical and metallurgical background. Ohio resident. Locate anywhere. Address: January 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES

SITUATION WANTED—Experienced sales person, widely known in metal working and finishing industry with 18 years successful record desires new company affiliation. Will consider manufacturer's agent arrangement on several non-competitive lines. Philadelphia headquarters. Address: March 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATION WANTED—I have many years experience on all metals. Capable of handling men and teaching beginners. Production and estimating on all types of work—floor lamps, hardware, silverware, plumbing supplies, jobbing shops and chandeliers and electrical fixtures. Desire position in either metropolitan New York or within commuting distance. Address: February 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

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SITUATION WANTED—36 years of age. Experienced in all phases of electroplating and anodizing, including control, development, and production. Primarily interested in deposition of noble metals and printed circuitry. Will consider relocation for position offering outstanding opportunity. Address: March 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROCHEMIST

SITUATION WANTED—Electrochemist, age 36, B.S. degree. Extensive experience in all phases of electroplating including control, research, trouble shooting and production. Extensive experience in plating on magnesium. Desire midwest location. Address: March 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

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241 Brunswick St., Hammond, Ind.
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Magnuson Products, Inc.
50 Court St., Brooklyn 1, N. Y.
Manhattan Rubber Div., Raybestos-Manhattan, Inc.
6 Willett St., Passaic, N. J.
Mearl Corp., The 105
124 E. 40th St., New York 16, N. Y.
Metal & Thermit Corp. 44
Rahway, N. J.
Michigan Buff Co. 127
3503 Gaylord Ave., Detroit 12, Mich.
Michigan Chrome & Chemical Co. 8
8615 Grinnell Ave., Detroit 13, Mich.
Miller Corp., Harry
4th & Bristol Sts., Philadelphia 40, Pa.
Mitchell-Bradford Chemical Co.
Wampus Lane, Milford, Conn.
Motor Repair & Mfg. Co., The 127
1555 Hamilton Ave., Cleveland 14, Ohio
Murray-Way Corp.
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
Mutual Chromium Chemicals, Solvay Process Div. 33
61 Broadway, New York 6, N. Y.
Nankervis Co., Geo. L.
15300 Fullerton Ave., Detroit 27, Mich.
National Polymer Products, Inc. 34A
Reading, Pa.
Narda Ultrasonics Corp., The
160 Herricks Rd., Mineola, L. I., N. Y.
Nazar Rubber Co., The 123
2727 Avondale, Toledo 7, Ohio
Northwest Chemical Co. 6
9310 Roselawn Ave., Detroit 4, Mich.
Norton Co. 30
1 New Bond St., Worcester 6, Mass.
Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.
Packer Machine Co.
456 Center St., Meriden, Conn.
Pennsalt Chemicals Corp. 90, 91
3 Penn Center Plaza, Philadelphia 2, Pa.
Pesco Plating Equipment Corp. 126
75 Wythe Ave., Brooklyn 11, N. Y.
Pfizer & Co., Inc., Chas.
630 Flushing Ave., Brooklyn 6, N. Y.
Phelps Dodge Refining Corp. 96
300 Park Ave., New York 22, N. Y.
Plating Products, Inc. 108
1509 N. Washington, Kokomo, Ind.
Potter Paint Co., Inc. 35
21 Crawford St., Cortland, N. Y.
Promat Div., Poor & Co. 35
851 S. Market St., Waukegan, Ill.
Ramco Equipment Corp. 118
807 Edgewater Rd., New York 39, N. Y.
Randolph Products Co.
92 N. 12th St., Carlstadt, N. J.
Rapid Electric Co. 9
2881 Middletown Rd., Bronx 61, N. Y.
Raybestos-Manhattan, Inc. Manhattan Rubber Div.
Passaic, N. J.
Reynolds Chemical Products Co.
1200 N. Main St., Ann Arbor, Mich.
Robertshaw Fulton Controls Co., Fulton Sylphon Div. 89
Knoxville 1, Tenn.
Rona Laboratories, Inc. 122
E. 21st & E. 22nd Sts., Bayonne 3, N. J.
Saran Lined Pipe Co. 7
2415 Burdette Ave., Ferndale 20, Mich.
Schori Process Div., FerroCo Corp.
8-11 43rd Rd., Long Island City, N. Y.
Sel-Rex Corp. 83, Inside Back Cover
75 River Rd., Nutley 10, N. J.
Service Screw Products Co.
131 N. Green St., Chicago 7, Ill.
Sethco Mfg. Co. 115
2286 Babylon Turnpike, Merrick, L. I., N. Y.
Seymour Mfg. Co.
4 Franklin St., Seymour, Conn.
Shell Chemical Corp. 10
380 Madison Ave., New York 17, N. Y.
Siefen Co., J. J. 111
5643 Lauderdale, Detroit 9, Mich.
Simonds Abrasive Co.
Tacony & Fraley Sts., Philadelphia 37, Pa.
Solvents Recovery Service 123
1025 Broad St., Newark 2, N. J.
Sommers Bros. Mfg. Co. 124
3439 No. Broadway, St. Louis 7, Mo.
Stevens, Inc., Frederic B. 31
1808 - 18th St., Detroit 16, Mich.
Stokes Corp., F. J.
5500 Tabor Rd., Philadelphia 20, Pa.
Storts Welding Co., Inc. 117
38 Stone St., Meriden, Conn.
Stutz Co., The
4430 W. Carroll Ave., Chicago 24, Ill.
Surety Rubber Co.
Carrollton, Ohio
Syntron Co. 100
Homer City, Pa.
Technic, Inc. 43
39 Snow St., Providence, R. I.
Ther Electric & Machine Works 103
19 So. Jefferson St., Chicago 6, Ill.
Timesavers, Inc. 106
Box 7446, Robinsdale Station, Minneapolis 22, Minn.
Tranter Mfg., Inc.
Lansing 9, Mich.
Trerice Co., The H. O. 118
1424 W. Lafayette Blvd., Detroit 16, Mich.
True Brite Chemical Products Co. 116
P. O. Box 31, Oakville, Conn.
Udylite Corp., The 12, 13
Detroit 11, Mich.
Unit Process Assemblies, Inc. 120
61 East 4th St., New York 3, N. Y.
U. S. Galvanizing & Plating Equipment Corp. 42
31 Heyward St., Brooklyn 11, N. Y.
U. S. Stoneware Co. 93
Akron 9, Ohio
Univertical Foundry & Machine Co. 40
14841 Meyers Rd., Detroit 27, Mich.
Victor Chemical Works 74A, B
155 No. Wacker Dr., Chicago 6, Ill.
Wagner Brothers, Inc. 15
418 Midland, Detroit 3, Mich.
Worthy Products Co. 127
Box 3415, St. Paul 1, Minn.
Wyandotte Chemicals Corp. 16
Wyandotte, Mich.
Zialite Corp.
92 Grove St., Worcester 5, Mass.

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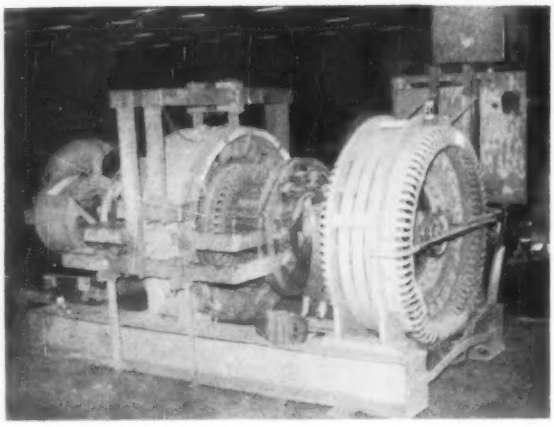

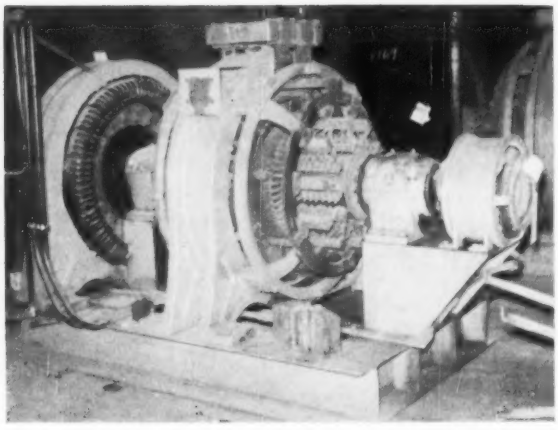

MANUFACTURE	AMPERAGE	VOLTAGE	VINTAGE	MOTOR SPECS
Electric Products	10,000	9	1944	150 HP
Chandeysson	7,500	9	1944	100
H-VW-M	7,500	12	1948	150
Electric Products	5,000	18	1944	150
Chandeysson	5,000	6	1941	40
Chandeysson	5,000	9	1942	75
Chandeysson	5,000	8	1944	75
Chandeysson	3,500	18	1944	100
H-VW-M	3,750	24	1948	150
H-VW-M	3,000	6	1946	30
Columbia	3,000	6	1946	30

All of the above are complete with full starting equipment and field rheostat control.
Input voltage 220/440/3/60 cycle. Commutators full and brushes good.

THE MOST IMPORTANT COST CUTTING PIECE OF EQUIPMENT IN THE METAL FINISHING INDUSTRY

6 only — ROTO-FINISH DW 60-36-2 compartment, each compartment 30 x 36", neoprene lined, variable speed, 220/440/3/60 cycle input. Reversing switches. Some have timer mechanism.

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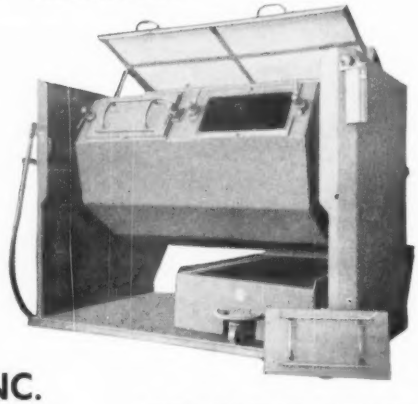

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Manufacturers' Literature

Heat Transfer Units

Tranter Mfg., Inc.

Bulletin IP-356, an eight page, illustrated brochure on Platecoil heat transfer units lists cost-saving advantages, information on fabrication, installation, operation and maintenance costs; and also lists specifications for the different types of units.

151/Circle on Readers' Service Card

Chemical Treatments of Metals

American Chemical Paint Co.

A new 8-page brochure describes various chemical conversion coatings for steel, aluminum, galvanized iron, zinc and cadmium plated surfaces; for corrosion resistance, paint bonding, drawing and forming, and protection for friction surfaces. Also listed are current specification chemicals for the Government and its contractors.

152/Circle on Readers' Service Card

Portable Air Compressor

Eclipse Air Brush Co.

New literature gives commercial results in spray painting from the power of an ordinary lighting line: 110v 15a.

153/Circle on Readers' Service Card

Emulsion Cleaner

Parke-Hill Chem. Corp.

A four page brochure describes Grease-Ban, a water emulsifiable and cleaning compound. In addition to describing the degreasing, cleaning, and disinfecting properties, the brochure tells how it is used for degreasing metals and metal products and for general plant maintenance.

154/Circle on Readers' Service Card

Rust Preventive Chart

Daubert Chemical Co.

Rust Preventive Chart No. 158 lists various military specifications and conforming Nox-Rust products. A detailed description of properties and applications of some of the leading rust preventives is included in the chart.

The new chart is designed to aid contractors, packaging engineers, and Government inspectors who need a ready reference to qualified preservatives for both military and commercial use.

155/Circle on Readers' Service Card

Water Treatment for Wet Spray Booths

North American Mogul Products Co.

New literature is available on "Mogul M-55," a liquid treatment for water wash paint spray booths which shows excellent results in protecting equipment and reclaiming overspray.

13 actual case histories point out the protective properties and preventative maintenance use of the product.

156/Circle on Readers' Service Card

Polyethylene Glycols

Union Carbide Chemicals Co.

A new, 54-page booklet on the properties, applications, storage, specifications, and testing of Carbowax polyethyelene glycols contains new data for potential users.

157/Circle on Readers' Service Card

Rubberized Abrasives

Cratex Mfg. Co.

Rubberized abrasives for deburring, smoothing and polishing applications are thoroughly covered in a new industrial catalog.

The 8-page catalog tells what the rubberized abrasives are, how they are used, and what they can do on a broad list of high precision manufacturing operations.

158/Circle on Readers' Service Card

Vapor Degreasing

Diamond Alkali Co.

An interesting, 12-page technical bulletin, recently issued, presents brief data covering 13 major advantages provided by vapor degreasing in production cleaning and metal surface preparatioon.

Related subjects discussed include

April 1958

READER SERVICE DEPARTMENT — METAL FINISHING

THIS CARD MUST BE USED BEFORE JUNE 1, 1958

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Company _____

Street _____

City _____ **Zone** _____ **State** _____

We manufacture (products) _____

☐ **Change my address. My present address is above and my old was**

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BUSINESS REPLY CARD

First Class Permit No. 46 (Sec. 34.9 P.L.&R.) Westwood, N. J.

READER SERVICE DEPARTMENT

METAL FINISHING

PEOPLES TRUST BUILDING

WESTWOOD, NEW JERSEY

the essentials of vapor degreasing equipment, methods of scheduling vapor degreaser cleanouts and solvent distillation, and suggested operating procedures. A tabulation of the physical properties of perchlorethylene completes this factual presentation.

159/Circle on Readers' Service Card

Exhaust Ducts

American Agile Corp.

"Thermoplastic Corrosion-Proof Ventilating and Exhaust Systems" is 12 pages in length. More than 31 illustrations are included. Specific components and fittings are arranged for ease of reference. With this catalog, a prospective user can determine the required components, their exact cost, and the most convenient lengths for installation. He can then design his own polyethylene ducting systems.

160/Circle on Readers' Service Card

Blast Cleaning

Wheelabrator Corp.

A 28-page handbook of blast cleaning, finishing and shot peening ideas utilizing the airless abrasive blast method includes more than 50 case history accounts.

161/Circle on Readers' Service Card

Acid Inhibitor

Sole Chemical Corp.

Technical Bulletin #258-1 describes "Sole-Onic PH-1," a new powdered acid inhibitor.

162/Circle on Readers' Service Card

Fiberglas Tanks

L. A. Darling Co., Plastics Div., Dept. MF, Coldwater, Mich.

A new brochure illustrates and describes the above manufacturer's noncorrosive type industrial plating tanks.

163/Circle on Readers' Service Card

Automatic Conveyors

Hanson-Van Winkle-Munning Co.

The part played by mass-production conveyors in the growing automation of metal finishing is described in a new 4-page, 2-color bulletin.

Featuring over a dozen photographs of actual in-plant adaptations of an extensive line of electroplating and anodizing conveyors Bulletin FAC-103 concisely describes these applications in terms of their flexibility and efficiency. Strides toward full automation made possible by recent advances in automatic barrel plating are also indicated.

A special section of the bulletin explains the manufacturer's Dial-A-Cycle system which allows nine or more anodizing or plating operations to be carried out automatically under the control of one operator. Also described is a new automatic load-unload for transfer points.

164/Circle on Readers' Service Card

Finishing Systems

Schmieg Industries, Inc.

Bulletin 600 approaches finishing problems from both the viewpoint of the large producer and the smaller concern. The bulletin covers washers, ovens and paint spray booths, including many isometric drawings of different types of equipment.

165/Circle on Readers' Service Card

Organic Protective Coatings

Rust-Oleum Corp.

A new thirty-six page protective coatings manual. Form No. 257, features color chips of 102 different coating items and includes complete sections devoted to methods of surface preparation, use of primers, and finish coatings, and the availability of special custom coatings where required.

166/Circle on Readers' Service Card

Spray Painting Equipment

Master Mfg. Co.

The above firm has available several leaflets on its spray painting equipment including spray guns, feed covers, respirators and pressure cups.

167/Circle on Readers' Service Card

Organic Coatings

Wisconsin Protective Coating Co.

The above firm announces the availability of Technical Bulletin No. 258 which describes "Plasite" high resistant protective coatings.

168/Circle on Readers' Service Card

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READER SERVICE DEPARTMENT

METAL FINISHING

PEOPLES TRUST BUILDING

WESTWOOD, NEW JERSEY

April 1958

READER SERVICE DEPARTMENT — METAL FINISHING

THIS CARD MUST BE USED BEFORE JUNE 1, 1958

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☐ **Change my address. My present address is above and my old was**

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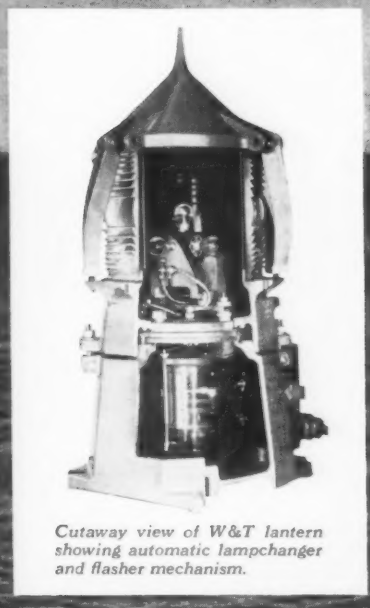
ANOTHER PLATING PROBLEM SOLVED BY SEL-REX!



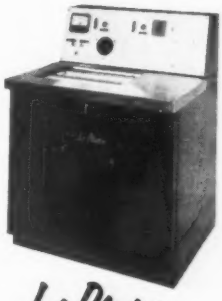
Cutaway view of W&T lantern showing automatic lampchanger and flasher mechanism.

WALLACE & TIERNAN SAVES 932 HOURS ON FIRST TWO JOBS WITH JET PLATER

Always alert to modern production methods, Wallace & Tiernan, Inc., Belleville, New Jersey, have realized almost incredible savings in production-time with their SEL-REX JET PLATER—the complete plating "plant" in a single compact package.

"Electroplating of flasher and lampchanger components used in Wallace & Tiernan's Aids To Navigation has always been an important part of our production," says Mr. C. W. Davis, Manager, Mechanical Manufacturing. "That's why we're so pleased with the substantial savings in production-time since we installed our JET PLATER. In addition, together with the Sel-Rex Bright Gold Process, we are now getting a Gold Plate superior to any we had ever produced before."

Whatever your plating problem — precious metals, power, equipment or procedures — Sel-Rex Representatives are trained to "Custom-Engineer" solutions to our mutual profit. Send for FREE technical data and other case histories, and see for yourself... we may have solved *your* problem last month.



Jet Plater

Complete electroplating "plant" in 34" x 28" x 33" cabinet.

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Manufacturers of Exclusive Precious Metals Processes, Metallic Power Rectifiers, Airborne Power Equipment, Liquid Clarification Filters, Metal Finishing Equipment and Supplies

NOW... Give Zinc Die Castings a Bright, Corrosion-Resistant Finish

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EXCELLENT PROTECTION... GOOD APPEARANCE... POSITIVE COLOR IDENTIFICATION WITH MacDERMID'S NEW GROUP OF CHEMICAL POLISHES

Not *every* application requires the brilliant, smooth finish of copper-nickel-chrome plating. MacDermid's chemical polishes provide a satisfactory finish with *better salt spray resistance* than plated finishes... at a fraction of the cost!

METEX 115F and METEX 113F: Gives a smooth, bright finish on zinc die castings. Also available for use on zinc or cadmium plate. Low operating cost and simple control.

METEX 113P: Gives a finish equal to mechanical methods. Parts may be used as finished or further processed and dyed. Production-tested and proved in use.

Write for complete technical data sheets, and get in touch with a MacDermid representative right away. He can recommend and service *complete* metal finishing cycles... he calls on a wide range of products and experience to solve your metal finishing problems... he's a good man to know!

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